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*Report of the Commissioners Appointed to Inquire into the Application of Iron to Railway Structures.**

From the information supplied to us, it appears that the proportions and forms at present employed for iron structures, have been generally derived from numerous and careful experiments, made by subjecting bars of wrought or cast iron, of different forms, to the action of weights, and thence determining by theory and calculation such principles and rules as would enable these results to be extended and applied to such larger structures and loads as are required in practice. But the experiments were made by dead pressure, and only apply therefore to the action of weights at rest. On the contrary, from the nature of the railway system, the structures employed therein are necessarily exposed to concussions, vibrations, torsions, and momentary pressures of enormous magnitude, produced by the rapid and repeated passage of heavy trains.

These disturbing causes, in smaller degree, have always occurred in structures connected with mill-work or other mechanism. But the effects upon their stability have not been found greater than could be met by increasing the dimensions of the parts without especially inquiring into the exact principles upon which such increase should be made. Thus, we are informed that the dimensions of cast iron girders, intended for sustaining stationary loads, such as water-tanks and floors, are usually so proportioned that their breaking-weight shall be three times as great as the load they are expected to carry, or in some cases four or five times as great. But when the girders are intended for railway bridges, and therefore sub-

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ject to much concussion and vibration, greater strength is given to them by altering the above proportions, and making the breaking-weight from six to ten times as great as the load, according to the practice of different engineers. On the other hand, some consider that one-third of the breaking-weight is as safe a load in the latter case as in the former.

As it soon appeared, in the course of our inquiry, that the effects of heavy bodies moving with great velocity upon structures had never been made the subject of direct scientific investigation, and as it also appeared that, in the opinion of practical and scientific engineers, such an inquiry was highly desirable, our attention was early directed to the devising of experiments for the purpose of elucidating this matter.

The questions to be examined may be arranged under two heads, namely—

1. Whether the substance of metal which has been exposed for a long period to percussions and vibrations, undergoes any change in the arrangement of its particles, by which it becomes weakened?

2. What are the mechanical effects of percussions, and of the passage of heavy bodies, in deflecting and fracturing the bars and beams upon which they are made to act?

A great difference of opinion exists among practical men with respect to the first of these questions. Many curious facts have been elicited by us in evidence, which show that pieces of wrought iron which have been exposed to vibration, such as the axles of railway carriages, the chains of cranes, &c., employed in raising heavy weights, frequently break after long use, and exhibit a peculiar crystalline fracture and loss of tenacity, which is considered by some engineers to be the result of a gradual change produced in the internal structure of the metal by the vibrations. In confirmation of this, various facts are adduced, as, for instance, that if a piece of good fibrous iron have the thread of a screw cut upon one end of it by the usual process of tapping, which is always accompanied by much vibratory action, and if the bar be then broken across, it will be found that the tapped part is a good deal more crystalline than the other portion of the bar. Others contend that this peculiar structure is the result of an original fault in the process of manufacture, and deny this effect of vibration altogether, whilst some allege that the crystalline structure can be imparted to fibrous iron in various ways, as by repeatedly heating a bar red-hot, and plunging it into cold water, or by continually hammering it, when cold, for half an hour or more.

Mr. Brunel, however, thinks the various appearances of the fracture depend much upon the mode in which the iron is broken. The same piece of iron may be made to exhibit a fibrous fracture when broken by a slow heavy blow, and a crystalline fracture when broken by a sharp short blow. Temperature alone has also a decided effect upon the fracture; iron broken in a cold state shows a more crystalline fracture than the same iron warmed a little.

The same effects are by some supposed to be extended to cast iron.

We have endeavored to examine this question experimentally in various ways.

A bar of cast iron, 3 inches square, was placed on supports about 14 feet asunder. A heavy ball was suspended by a wire 18 feet long, from

the roof, so as to touch the centre of the side of the bar. By drawing this ball out of the vertical position at right angles to the length of the bar, in the manner of a pendulum, to any required distance, and suddenly releasing it, it could be made to strike a horizontal blow upon the bar, the magnitude of which could be adjusted at pleasure, either by varying the size of the ball or the distance from which it was released. Various bars (some of smaller size than the above) were subjected by means of this apparatus to successions of blows, numbering in most cases as many as 4000, the magnitude of the blow in each set of experiments being made greater or smaller as occasion required. The general result obtained was, that when the blow was powerful enough to bend the bars through one-half of their ultimate deflexion, (that is to say, the deflexion which corresponds to their fracture by dead pressure,) no bar was able to stand 4000 of such blows in succession; but all the bars, when sound, resisted the effects of 4000 blows, each bending them through one-third of their ultimate deflexion.

Other cast iron bars, of similar dimensions, were subjected to the action of a revolving cam, driven by a steam engine. By this they were quietly depressed in the centre, and allowed to restore themselves, the process being continued to the extent even, in some cases, of 100,000 successive periodic depressions for each bar, and at a rate of about four per minute. Another contrivance was tried, by which the whole bar was also, during the depression, thrown into a violent tremor. The results of these experiments were, that when the depression was equal to one-third of the ultimate deflexion, the bars were not weakened. This was ascertained by breaking them in the usual manner with stationary loads in the centre. When, however, the depressions produced by the machine were made equal to one-half of the ultimate deflexion, the bars were actually broken by less than 900 depressions. This result corresponds with and confirms the former.

By other machinery, a weight equal to one-half of the breaking-weight was slowly and continually dragged backwards and forwards from one end to the other of a bar of similar dimensions to the above. A sound bar was not apparently weakened by 96,000 transits of the weight.

It may, on the whole, therefore be said that, as far as the effects of reiterated flexure are concerned, cast iron beams should be so proportioned as scarcely to suffer a deflexion of one-third of their ultimate deflexion. And as it will presently appear that the deflexion produced by a given load, if laid on the beam at rest, is liable to be considerably increased by the effect of percussion, as well as by motion imparted to the load, it follows, that to allow the greatest load to be one-sixth of the breaking-weight is hardly a sufficient limit for safety, even upon the supposition that the beam is perfectly sound.

In wrought iron bars no very perceptible effect was produced by 10,000 successive deflexions by means of a revolving cam, each deflexion being due to half the weight which, when applied statically, produced a large permanent flexure.

Under the second head, namely, the inquiry into the mechanical effects of percussions and moving weights, a great number of experiments have been made to illustrate the impact of heavy bodies on beams. From these it appears that bars of cast iron of the same length and weight, struck hori-

zontally by the same ball, (by means of the apparatus above described for long continued impact,) offer the same resistance to impact whatever be the form of their transverse section, provided the sectional area be the same. Thus a bar, $6 \times 1\frac{1}{2}$ inches in section, placed on supports about 14 feet asunder, required the same magnitude of blow to break it in the middle, whether it was struck on the broad side or the narrow one, and similar blows were required to break a bar of the same length, the section of which was a square of 3 inches, and therefore of the same sectional area and weight as the first.

Another course of experiments tried with the same apparatus showed, amongst other results, that the deflexions of wrought iron bars produced by the striking ball were nearly as the velocity of impact. The deflexions in cast iron are greater than in proportion to the velocity.

A set of experiments was undertaken to obtain the effects of additional loads spread uniformly over a beam, in increasing its power of bearing impacts from the same ball falling perpendicularly upon it. It was found that beams of cast iron, loaded to a certain degree with weights spread over their whole length, and so attached to them as not to prevent the flexure of the bar, resisted greater impacts from the same body falling on them than when the beams were unloaded, in the ratio of two to one. The bars in this case were struck in the middle by the same ball falling vertically, through different heights, and the deflexions were nearly as the velocity of impact.

We have also carried on a series of experiments to compare the mechanical effect produced by weights passing with more or less velocity over bridges, with their effect when placed at rest upon them. For this purpose, amongst other methods, an apparatus was constructed, by means of which a car, loaded at pleasure with various weights, was allowed to run down an inclined plane; the iron bars which were the subject of the experiment were fixed horizontally at the bottom of the plane, in such a manner that the loaded car would pass over them with the velocity acquired in its descent. Thus the effects of giving different velocities to the loaded car, in depressing or fracturing the bars, could be observed and compared with the effects of the same loads placed at rest upon the bar.

This apparatus was on a sufficiently large scale to give a practical value to the results; the upper end of the inclined plane was nearly 40 feet above the horizontal portion, and a pair of rails, 3 feet asunder, were laid along its whole length for the guidance of the car, which was capable of being loaded to about 2 tons; the trial bars, 9 feet in length, were laid in continuation of this railway at the horizontal part, and the inclined and horizontal portions of the railway were connected by a gentle curve. Contrivances were adapted to the trial bars, by means of which the deflexions produced by the passage of the loaded car were registered; the velocity given to the car was also measured, but that velocity was, of course, limited by the height of the plane, and the greatest that could be obtained was 43 feet per second, or about 30 miles per hour.

A great number of experiments were tried with this apparatus, for the purpose of comparing the effects of different loads and velocities upon bars of various dimensions, and the general result obtained was, that the deflexion produced by a load passing along the bar was greater than that

which was produced by placing the same load at rest upon the middle of the bar, and that this deflexion was increased when the velocity was increased. Thus, for example, when the carriage, loaded to 1120 lbs., was placed at rest upon a pair of cast iron bars, 9 feet long, 4 inches broad, and $1\frac{1}{2}$ inches deep, it produced a deflexion of $\frac{6}{10}$ths of an inch; but when the carriage was caused to pass over the bars at the rate of 10 miles an hour, the deflexion was increased to $\frac{8}{10}$ths, and went on increasing as the velocity was increased, so that at 30 miles per hour, the deflexion became $1\frac{1}{2}$ in.; that is, more than double the statical deflexion.

Since the velocity so greatly increases the effect of a given load in deflecting the bars, it follows that a much less load will break the bar when it passes over it than when it is placed at rest upon it, and, accordingly, in the example above selected, a weight of 4150 lbs. is required to break the bars if applied at rest upon their centres; but a weight of 1778 lbs. is sufficient to produce fracture if passed over them at the rate of 30 miles an hour.

It also appeared that, when motion was given to the load, the points of greatest deflexion, and, still more, of the greatest strains, did not remain in the centre of the bars, but were removed nearer to the remote extremity of the bar. The bars, when broken by a traveling load, were always fractured at points beyond their centres, and often broken into four or five pieces, thus indicating the great and unusual strains they had been subjected to.

We have endeavored to discover the laws which connect these results with each other and with practice, and for this purpose a smaller and more delicate apparatus was constructed to examine the phenomena in their simplest form—namely, in the case of a single weight traversing a light elastic bar. For the weight in its passage along the bar deflects it, and thus the path or trajectory of the centre of the weight, instead of being a horizontal straight line, as it would be if the bar were perfectly rigid, becomes a curve, the form of which depends upon the relation between the length, elasticity, and inertia of the bar, the magnitude of the weight, and the velocity imparted to it. If the form of this curve could be perfectly determined in all cases, the effects of traveling loads upon bars would be known; but, unfortunately, the problem in question is so intricate that its complete mathematical solution appears to be beyond the present powers of analysis, except in the simplest and most elementary case—namely, in which the load is so arranged as to press upon the bar with one point of contact only, or, in other words, the load is considered as a heavy moving point. In practice, on the contrary, a single four-wheeled carriage touches each rail or girder in two points, and a six-wheeled engine, with its tender, has five or six points in contact on each side. This greatly complicates the problem.

The above smaller apparatus is so arranged as to comply with the simple condition that the load shall press upon one point only of the bar, and is also furnished with a contrivance by which the effects of various proportions of the mass of the bar to that of the load can be examined. From the nature of the problem, it is convenient to consider, in the first place, the forms of the trajectories that are described, and the corresponding de-

flexions of the bar, when the mass of the bar is exceedingly small compared with that of the load.

Having obtained these under different relations of the length of the bridge, its statical deflexion, and the velocity of the passing load, we proceed to investigate, in addition, the effect which a greater proportional mass of the bar or bridge has upon the deflexions. We have been greatly assisted in this research by a most elaborate and complete analytical investigation by George Stokes, Esq., Fellow of Pembroke College, Cambridge, undertaken at the request of one of the members of the Commission. Unfortunately, the extreme difficulty of the problem has rendered its solution unattainable excepting in the cases in which the mass of the bridge is supposed to be exceedingly small compared with that of the load, and in the opposite case in which the mass of the load is supposed to be small compared with that of the bridge. The examples that occur in practice lie between these two extremes; for in the experiments of the Commission, performed at Portsmouth, with the inclined plane already described, the weight of the load was from three to ten times that of the bar; but this is a much greater proportion than that which occurs in bridges, partly on account of the necessity for employing in experiments very flexible bars, to render the changes of deflexion sufficiently apparent, and partly on account of the great difference of length; for if bars bearing the same ratio of weight to that of the load were employed in experiment, the deflexion would become so small as to be scarcely appreciable. This will readily be perceived when it is stated that, in a bridge of 33 feet long, a deflexion not greater than one-fourth of an inch is usually allowed, which deflexion is only $\frac{1}{1440}$th part of its length; whereas, in experiment, it is necessary to employ deflexions of two or more inches. In actual bridges of about 40 feet span, the weight of the engine and tender is very nearly the same as the weight of that half of the bridge over which it passes; and in large bridges the weight of the load is much less than that of the bridge.

Mr. Stokes has shown that, when the inertia of the bridge is supposed small, the trajectories of the load and the corresponding deflexion of the bridge depend upon a certain quantity, which he terms β; this quantity varies directly as the square of the length of the bar, and inversely as the product of the central statical deflexion, (namely, that which would be produced by the load set at rest on the centre of the bridge,) and of the square of the velocity with which the load passes over the bridge. When β is small, the increase of deflexion due to the velocity of the load becomes very great, so much so that if β be equal to 1·3, the statical deflexions are doubled, and are tripled when $\beta = 0{\cdot}8$; becoming still greater as lesser values of β are taken. On the contrary, greater values of β correspond to small deflexions; and it has been shown by our researches that, in the cases of real bridges, β is rarely less than 14, and is commonly very much greater; and that, consequently, the greatest increase of deflexion from velocity would be, upon this theory, never greater than one-tenth, varying from that to one-hundredth, or less. As β varies directly as the square of the length of the bridge, it is plain that the nine-feet bars of the Portsmouth experiments will correspond to much less values of β than the 20 and 30-feet lengths of actual bridges; while the values of β in the former cases are still further diminished by the greater deflexions necessarily

employed in experiments, as above explained. It is thus shown that the enormous increase of deflexion produced by velocity in the Portsmouth experiments cannot occur with real bridges, since it appears that the phenomena in question are developed to a great extent when the magnitude of the structure is diminished. But these calculations are made upon the supposition that the inertia of the bridge is very small; and experiments made with the small apparatus above mentioned have shown that, while β is less than about unity, the inertia of the bridge tends to diminish the deflexion; while, on the other hand, when β is greater than unity, (including, of course, all practical cases,) the inertia of the bridge tends to increase the deflexions, obtained upon the above supposition. Lastly, the total increase of the statical deflexion, when the inertia of the bridge is taken into account, will be found much greater for short bridges than for long bridges. Supposing, for example, the mass of the traveling load and of the bridge to be nearly equal, the increase of the statical deflexion at the highest velocities, for bridges of 20 feet in length, and of the ordinary degree of stiffness, may be more than one-half; whereas, for bridges of 50 feet in length, the increase will not be greater than one-seventh, and will rapidly diminish as greater lengths are taken. But as it has been shown that the increase *cæteris paribus* is diminished by increasing the stiffness of the bridge, we always have it in our power to reduce its amount within safe limits. Hence in estimating the strength of a railway bridge, this increase of the statical deflexion must be taken into account, by calculating it from the greatest load which is likely to pass over the bridge, and from the highest possible velocity. It must be remembered, also, that this deflexion is liable to be increased by jerks produced by the passage of the train over the joints of the rails.

We also made some experiments by means of the large apparatus before mentioned, on curved bars, and these bore much greater weights at high velocities than straight bars; but the deflexions of these bars were very great compared with their length. In drawing attention to these experiments, we would remark that, in actual structures, where the deflexions are so very small, the effect of cambering the girders, or of forming a curved pathway for the load, would be of less comparative importance, and might tend to introduce practical inconvenience.

The general impression among engineers appears to be at variance with the above results. They, for the most part, state their belief that the deflexion caused by passing a weight at a high velocity over a girder, is less than the deflexion which would be produced by the same weight at rest; even when they have observed an increase, they have attributed it solely to the jerks of the engine or train, produced by passing over inequalities at the junction of the rails, or other similar causes.

For the purpose of examining this question, we have submitted two actual bridges to the test of experiment. These bridges, one of which, the Ewell Bridge, is situated upon the Croydon and Epsom line, and the other, the Godstone Bridge, upon the South Eastern line, are both constructed to carry the railway over a road. A scaffold was constructed, which rested on the road, and was, therefore, unaffected by the motion of the bridge, and a pencil was fixed to the under side of one of the girders of the bridge, so that when the latter was deflected by the weight of the engine or train,

either placed at rest or passing over it, the pencil traced the extent of deflexion upon a drawing board attached to the scaffold. An engine and tender, which had been in each case liberally placed under our orders by the directors of the companies, was made to traverse the bridges at different velocities, or rest upon them at pleasure. The span of the Ewell Bridge is 48 feet, and the statical deflexion due to the above load rather more than one-fifth of an inch. This was slightly but decidedly increased when the engine was made to pass over the bridge, and at a velocity of about 50 miles per hour, an increase of one-seventh was observed. As it is known that the strain upon a girder is nearly proportional to the deflexion, it must be inferred that, in this case, the velocity of the load enabled it to exercise the same pressure as if it had been increased by one-seventh, and placed at rest upon the centre of the bridge. The weight of the engine and tender was 39 tons, and the velocity enabled it to exercise a pressure upon the girder equal to a weight of about 45 tons. Similar results were obtained from the Godstone Bridge. We would take this opportunity of mentioning how much we are indebted to Mr. P. W. Barlow, and to Mr. Hood, for the assistance they afforded us in making these experiments.

We have also to express our obligations to the Astronomer Royal, for the advantage of his presence during the above and other experiments, as well as for many valuable suggestions during the progress of the inquiry.

In addition to the above experiments, we have made many for the purpose of supplying data for completing the mechanical theory of elastic beams. If a beam be in any manner bent, its concave side will be compressed, and its convex side extended. An exact knowledge of the laws which govern its compression and extension must precede any accurate general theory of its deflexions, vibrations, and ruptures.

The law which is usually assumed in mathematical investigations, and by which the longitudinal compressions and extensions, within certain limits, are assumed to be directly proportional to the forces by which they are produced, although very nearly true in some bodies, is not, perhaps, accurately true for any material.

Experiments have, therefore, been made to determine with precision the direct longitudinal extension and compression of long bars of cast and wrought iron. The extensions were determined by attaching a bar, 50 feet in length and 1 inch square, to the roof of a lofty building, and suspending weights to its lower extremity.

The compressions were ascertained by enclosing a bar, 10 feet long and 1 inch square, in a groove placed in a cast iron frame, which allowed the bar to slide freely without friction, and yet permitted no lateral flexure. The bar was then compressed by means of a lever loaded with various weights. Every possible precaution was taken to ensure accuracy. The following formulæ were deduced for expressing the relation between the extension and compression of a bar of cast iron, 10 feet long and 1 inch square, and the weights producing them respectively:—

Extension, $w = 116117e - 201905e^3$.
Compression, $w = 107763d - 36318d^3$.

Where w is the weight in pounds acting upon the bar, e the extension, and d the compression in inches.

And the formulæ deduced from these for a bar 1 inch square, and of any length, are—

$$\text{For Extension,} \quad w = 13934040\,\frac{e}{l} - 2907432000\,\frac{e^2}{l^2}.$$

$$\text{For Compression,} \quad w = 12931560\,\frac{d}{l} - 522979200\,\frac{d^2}{l^2}.$$

Where l is the length of the bar in inches.

These formulæ were obtained from the mean results of four kinds of cast iron.

The mean tensile strength of cast iron derived from these experiments is 15,711 lbs. per square inch, and the ultimate extension $\frac{1}{86}$ of the length, and this weight would compress a bar of iron of the same section $\frac{1}{775}$ of its length. It must be observed that the usual law is very nearly true for wrought iron.

Many denominations of cast iron have got into common use, of which the properties had not yet been ascertained with due precision. Seventeen kinds of them have been selected, and their tensile and crushing forces determined. Experiments have also been made upon the transverse strength and resistance of bars of wrought and cast iron acted upon by horizontal as well as vertical forces. These experiments will be found to exhibit very fully the deflexions and sets of cast iron, and the defect of its elasticity.

The bars which were experimented upon by transverse pressure, were of sections varying from 1 inch square to 3 inches square, and of various other sections, and the actual breaking weights show that the strength of a bar 1 inch square should not be taken as the unit for calculating the strength of a larger casting of similar metal, although the practice of doing so has been a prevalent one, for it appears that the crystals in the portion of the bar which cools first are small and close, whilst the central portion of bars 2 inches square, and 3 inches square, is composed of comparatively large crystals, and bars of 3 inches square in section, planed down on all sides alike to $\frac{3}{4}$ of an inch square, are found to be very weak to resist both transverse and crushing pressure. Hence it appears desirable, in seeking for a unit for the strength of iron of which a large casting is to be made, that the bar used should equal in thickness the thickest part of the proposed casting.

The performance of these various experiments has been greatly facilitated by the permission which was liberally granted to us by the Lords Commissioners of the Admiralty, to make use of Portsmouth Dockyard in carrying on our investigations, in addition to which, however, we found it necessary to hire for several months some premises in Lambeth. This was found requisite for the performance of those portions of the experimental inquiry which had been undertaken by Eaton Hodgkinson, Esq. Although we are aware that, to point out the labors of individual members of the Commission would be impossible, and that it may appear invidious to single one out for praise, we cannot resist the expression of our thanks to the above-named gentleman, for the zeal and intelligence with which he has carried out the remarkable series of experiments which are detailed in the Appendix to this Report, and which constitute a large proportion of those which have been already described.

In addition we have obtained, from many of the iron-masters, information respecting the various processes employed by them in the manufacture of their irons, and the effect of such processes upon the strength and properties of the material produced; and we have also made careful inquiries of civil engineers with respect to the qualities and mixtures of iron preferred by them, for the large castings used in the construction of railway bridges, and to the respective properties of hot-blast and cold-blast iron; this investigation has been greatly facilitated by the liberality and candor with which these gentlemen have communicated to us the results of their experience.

As no map of the kingdom had been constructed representing the districts in which iron is found and worked, we applied to the officers of the Museum of Practical Geology for their assistance, and they caused one to be prepared expressly to accompany this Report, in which the principal furnaces now in blast are shown.

Great differences of opinion exist with respect to the best qualities and mixtures of iron; and, after all, it appears that those employed for large castings depend practically so much upon the commercial question of relative cost, that engineers are rarely able to select the very best material. It is generally admitted that engineers have no guarantee that the mixture for which they have stipulated in a contract shall be that used by the founder, and no certain test by which to determine whether a given piece of iron has been manufactured by hot or cold blast. A very good protection appears to be contained in the recommendation of Mr. Fox, that engineers, in contracting for a number of girders, should stipulate that they should not break with less than a certain weight, (leaving the mixture to the founder,) and cause one more than the required number to be cast. The engineer may then select one to be broken, and if it break with less weight than that agreed upon, the whole may be rejected.

At the beginning of the railway system, the bridges were naturally constructed upon similar principles to those which had been already employed for common roads or aqueducts. Some of these ordinary constructions have proved inadequate to sustain the enormous loads and vibrations of railway trains. Some have been considered too expensive; others, as the suspension bridges, have been found wholly unfitted for railway purposes. Moreover, the necessity for preserving the level of a railroad as much as possible, combined with that of passing under or over existing canals, rivers, or roads, has created a demand for those forms of bridges which admit of being kept as low as possible, consistently with the proper headway or passage below; or, in other words, of making the least possible difference of level between the road or stream which the bridge has to carry and that which it has to cross.

From these causes, combined with the innumerable opportunities of building new bridges which the railways have given occasion to, and a constant endeavor to reduce the expense of building them, a variety of new constructions have been proposed and essayed, most of them of great merit and value, while others appear to be of very doubtful stability.

On the whole, the art of railway bridge-building cannot be said to be in that settled state which would enable an engineer to apply principles with

confidence. We have, therefore, thought it our duty to inquire into the present methods of railway bridge-building, to collect in evidence the opinions and practice of the leading members of the profession of civil engineers upon this branch of construction, and especially with respect to the form and proportions of simple cast iron girders, the practical limits to the employment of such girders, the methods of combining them with the rest of the structure, the various forms of compound girders, the expediency of several combinations of wrought iron with cast iron; and, finally, the comparative merits of plain girders, and of other forms in which the principles of the arch, or other methods of giving stiffness, are introduced.

The simplest bridge, and that which admits of the greatest possible headway at a given elevation, is, undoubtedly, the straight girder bridge.

The length of a simple cast iron girder appears to be limited only by the power of making sound castings, and the difficulty of moving large masses. Thus the practical length has been variously stated to us as 40, 50, and 60 feet. The form resulting from Mr. Hodgkinson's former experiments on this subject, is universally admitted to be that which gives the greatest strength; but the requirements of construction compel many variations from it, especially in the ratio between the top and bottom flanches. Moreover, the convenience and the necessity of keeping the roadway for rails as low as possible, has introduced a practice of supporting the beams which sustain the rails upon one side of the bottom flanch. The pressure of the roadway, and of the passing loads, being thus thrown wholly on one side of the central vertical web of the girder, produces torsion (which is not always taken into account in determining the proportions of the girder.) The existence of this torsion is admitted on all hands, and various schemes are employed to counteract and diminish it; but the form of a girder that will effectually resist this disturbing force, without incurring other evils, still remains a desideratum.

The requisite length of girders is increased considerably by the excessive use of skew bridges; and it is much to be regretted that difficulties should often be thrown in the way of altering the course of existing roads and canals when the line of a proposed railway happens to cross them at an acute angle. Partly from these causes, and partly from a little indulgence in the pride of construction, skew bridges may be found, of which, from the obliquity of the bridge, the girders are more than double the length that would be required by the direct span of the opening to be crossed.

When the span of the opening or other circumstances render the use of single straight girders unadvisable, straight girders built up of several separate castings bolted together, and sometimes trussed with wrought iron tension rods, are largely employed, and necessarily with great varieties of construction. By these means the girders may be extended to spans of upwards of 120 feet.

When wrought iron is combined with cast iron in the manner of trussing, several difficulties arise from the different expansions of the two metals, and the difference of their masses, which causes the wrought iron rods to be more rapidly affected by a sudden change of temperature than the cast iron parts. The constant strain upon the wrought iron tends to produce

a permanent elongation, and hence tension rods may require to be occasionally screwed up. We have sought for opinions and information upon all these questions, and these show that the greatest skill and caution are necessary to insure the safe employment of such combinations. It is not admitted that the vibration of railway trains would loosen or injure the bolts or rivets of compound girders. Nevertheless, wood, felt, or other similar substances, have occasionally been introduced between surfaces to diminish the communication of vibration.

The general opinion of engineers appears to be, that the cast iron arch is the best form for an iron bridge, when it can be selected without regard to expense or to the height above the river or road which is to be crossed. For low bridges, the bowstring girder is recommended. Lattice bridges appear to be of doubtful merit.

The latest mode of construction that has been introduced consists of boiler plates, riveted together as in iron ship-building, and combined in various ways with cast iron. Hollow girders are thus formed, which are either made so large as to admit of the road and carriages passing through them, as in the Conway and Britannia bridges, or else these tube girders are made on a smaller scale, and employed in the same manner as the ordinary cast iron girders, to sustain transverse joists which carry the road. The first kind is applicable to enormous spans, those of the two bridges above mentioned being 400 and 462 feet respectively. The second kind are said to be cheaper and more elastic than other forms for spans that exceed 40 feet.

These methods appear to possess and to promise many advantages, but they are of such recent introduction that no experience has yet been acquired of their powers to resist the various actions of sudden changes of temperature, vibrations, and other causes of deterioration. We have thought it our duty to seek for information with respect to them, and we find engineers to be, for the most part, exceedingly favorable towards them; but, for the reasons above stated, we are unable to express any opinion upon them. At the same time, we desire to bear testimony to the patient care and scientific manner in which the forms and proportions of the great tubes of the Conway and Britannia bridges have been elaborated; and we must beg to refer to the Minutes of Evidence for the details of the information which we have collected.

The investigation in which we have been concerned has made it evident that the novelty of the railway system has introduced a variety of new mechanical causes, the effects of which have not yet had time fully to develop themselves, on account of the extent and number of new railways, and the rapidity with which they were constructed,—in many cases scarcely giving breathing time to the engineers, by which to observe and profit by the experience of each successive new construction. Thus it has happened that some portions of mechanism and structure have been made too weak, or placed in unfavorable combinations; and hence some unavoidable, but most lamentable, and sometimes fatal, accidents have been occasioned. It also appears that there exists a great want of uniformity in practice in many most important matters relating to railway engineering, which shows how imperfect and deficient it yet is in leading principles.

But we have also observed throughout the present inquiry that the engineers have been already warned by experience of the necessity for increasing the strength of bridges employed in railways; and of watching more narrowly their construction, so as to render them as strong as possible. Accordingly we have found that the original structure of all those bridges which had shown the least signs of weakness, has been carefully altered and strengthened, so as to leave no apparent cause for apprehension; while in new bridges, better and stronger combinations are adopted.

And in conclusion, considering that the attention of engineers has been sufficiently awakened to the necessity of providing a superabundant strength in railway structures, and also considering the great importance of leaving the genius of scientific men unfettered for the development of a subject as yet so novel and so rapidly progressive as the construction of railways, we are of opinion that any legislative enactments with respect to the forms and proportions of the iron structures employed therein would be highly inexpedient.

We would, however, direct attention to the general conclusions we have arrived at from our own experiments, and from the information supplied to us, namely,—

That it appears advisable for engineers, in contracting for castings, to stipulate for iron to bear a certain weight instead of endeavoring to procure a specified mixture.

That, to calculate the strength of a particular iron for large castings, the bars used as a unit should be equal in thickness to the thickest part of the proposed casting.

That, as it has been shown that to resist the effects of reiterated flexure, iron should scarcely be allowed to suffer a deflexion equal to one-third of its ultimate deflexion, and since the deflexion produced by a given load is increased by the effects of percussion, it is advisable that the greatest load in railway bridges should, in no case, exceed one-sixth of the weight which would break the beam when laid on at rest in the centre.

That, as it has appeared that the effect of velocity communicated to a load is to increase the deflexion that it would produce if set at rest upon the bridge; also that the dynamical increase in bridges of less than 40 feet in length is of sufficient importance to demand attention, and may, even for lengths of 20 feet, become more than one-half of the statical deflexion at high velocities, but can be diminished by increasing the stiffness of the bridge; it is advisable that, for short bridges especially, the increased deflexion should be calculated from the greatest load and highest velocity to which the bridge may be liable; and that a weight which would statically produce the same deflexion should, in estimating the strength of the structure, be considered as the greatest load to which the bridge is subject.

Lastly, the power of a beam to resist impact varies with the mass of the beam, the striking body being the same, and by increasing the inertia of the beam without adding to its strength, the power to resist impact is, within certain limits, also increased. Hence it follows that weight is an important consideration in structures exposed to concussions.

Whilst, however, we lament that the limited means which have been placed at our disposal, and the great time required for such investigations, have compelled us to leave in an imperfect state, or even to neglect alto-

gether, many interesting and important branches of experimental inquiry, we trust that the facts and opinions which we have been enabled to collect will serve to illustrate the action which takes place under varying circumstances in iron railway bridges, and enable the engineer and mechanic to apply the metal with more confidence than heretofore.

WROTTESLEY.
ROBERT WILLIS.
HENRY JAMES.
GEORGE RENNIE.
W. CUBITT.
EATON HODGKINSON.

DOUGLAS GALTON, *Lieut. Royal Engineers,*
Secretary.

Whitehall, 26th July, 1849.

To be continued.

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*Opening of the Victoria Suspension Bridge, at Lochabar, Scotland.**

At the dinner in celebration of the opening of the Victoria Suspension Bridge over the river Lochy, between Fort William and Corpach, built at the expense of "Lochiel," Mr. Dredge, the inventor of the peculiar system of suspension adopted for the bridge, made the following remarks:

Mr. Dredge, after thanking the company for the compliment paid him, observed that it was to Lochiel the compliment was due for his appreciation of, and confidence in, the new principle. After referring to the disadvantages of ferries, he proceeded:—"The confined limits of the stone arch for spanning broad rivers and ravines, with the difficulty of obtaining level roads over them, has kept it out of the reach of many a proprietor, who would otherwise have gladly bestowed on the public the advantages of a bridge. Therefore, in numerous instances, to their great prejudice, a great inconvenience has long been borne with. The timber bridge, it is true, is less expensive, but its durability is short, hence the rude ferry-boat is still a substitution for a bridge in various places, especially in the Highlands; but it might almost universally be dispensed with, for the principle upon which the bridge has just been erected over the Lochy affords every person who wants a bridge the opportunity of no longer putting up with inconvenience; it is so truly economical, powerful, and durable, not of the costly stone material, nor of timber, which is calculated to last but thirty years, is it built, but of iron, the durability of which we cannot compute, as iron bridges are of modern date.

"A stone bridge at Lochy Ferry was estimated to cost £8000, which sum, I believe, was the lowest tender. But it was to be composed of many arches, and as many piers in the river, obstructing its impetuous current, and probably damaging the valuable salmon fishings. The object is now attained with a level iron bridge, at a cost of less than £2000, without the least obstruction to the current, whereby the liability of ever being overturned by flood or storm is avoided, and, consequently, its *first* will be the *principal* cost. The span of the bridge is 250 feet; platform nearly 17

* From the London Mechanics' Magazine, for February, 1850.

wide; clear roadway 15; the masonry at the base 28 feet by 16 feet, and built solid up to the roadway 19 feet high, above which each arched entrance is 12½ feet wide and 20 feet high; and the top of the piers upon which the chains rest, is 24 feet above the roadway, and the whole tapers three-fourths of an inch to the foot in elevation, excepting four feet of plumb which supports the arches. It is built of the best granite, of rock-work, without a tool-mark visible above the road. The care and attention of the workmen were devoted to making good beds and joints for the substantiality of the structure. The versed sine of the bridge is one-tenth of the chord line, and it consumed 40 tons of wrought and cast iron. The section of the four chains at the top of the piers is 50 inches, which taper to 0 at the centre of the bridge; hence its strength for transit use is 250 tons, namely, about one-third of its ultimate power. The platform contains 3600 feet of surface, which will admit of 360 head of cattle being upon it at one time, and this will be the heaviest load to which it will be subject. Now, allowing each to weigh 4 cwt., the load will be only 72 tons, which will leave a surplus power of 178 tons.

"The foundation stone was laid on the 6th of August last, and, deducting the time lost by inclement weather and short days, the bridge was only three months in building. The first bridge on this plan was the Victoria, in Bath, erected in 1836, and now there are nearly fifty. The British and Indian Governments have adopted it, and many others, as well as Lochiel, and it is beginning to be appreciated in every quarter."

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*Deflexion of Iron Girders.**

It is considered that girders should not deflect more than $\frac{1}{600}$th to $\frac{1}{400}$th of their length, according to the form of the girder. It does not appear, from the evidence given before the Strength of Iron Commission, that a weight equal to what a girder is constructed to carry, will, even if left on for any length of time, cause the deflexion of the girder to increase, unless subjected at the same time to considerable changes of temperature. Some experiments made by Mr. Fairbairn and Mr. Braidwood show that iron loses a considerable proportion of its strength when heated to a temperature of more than 220° F., and that it becomes uncertain below 32°. Mr. Clark described the effect of the sun coming out and shining on the Conway tubular bridge for half an hour to have been to raise the tube vertically one inch; and he mentions that, at night, from the lower temperature, the deflexion was always greater than in the day-time. Mr. Fox instances the effect of frequent and great changes of temperature on some short girders, 6 feet long, which support the hoods of the forges in his workshops. In the day-time they are so warm that the hand can only just bear the heat, and at night they become cold. The effect is to make the girders *swag*, and the swagging appears to be continually increasing. Some have attained as much at 3″ deflexion in the centre; but their strength does not seem to be impaired.

The general opinion as to the amount of test which should be applied to girders appeared to be, that the test should amount to twice the greatest

* From the London Builder, No. 366.

load. Mr. Joseph Cubitt would employ three times the greatest load, or half the breaking weight; and Mr. Thomas Cubitt considers it safer to test a girder almost to the extent that would break it than not to prove it at all, as the testing of girders is the only means of discovering defects under the surface, and concealed from the eye. Mr. Brunel, however, thinks that a girder should not be tested with a weight exceeding the greatest load, as the object in testing is to ascertain the soundness of the casting, which may be judged of by its appearance under the load, and all risk of permanent injury should be carefully avoided.

AMERICAN PATENTS.

List of American Patents which issued in November, 1849, *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improved Method of Flooding and Entering Gunpowder Magazines;* Chas. W. Copeland, Brooklyn, New York, November 6.

The patentee says,—"The nature of my invention consists in improvements in gunpowder magazines for ships, whereby they are rendered more safe from explosions by the action of fire, either in the time of battle or from accidental conflagration; said magazines having also improvements for entering and leaving the same, and for conveying powder into and from it without risk from external fire."

Claim.—"What I claim as my invention, is attaching to, and combining with, the known magazine, having its ejection and injection pipes for flooding and continuing a circulation of cold water though it, and the governing cocks connected together, a connecting piece to be affected by heat without necessarily coming in contact with fire; this connecting piece being governed by a spring when not caused to operate, and being capable, by the action of heat, to flood the magazine; the whole being arranged or constructed substantially as herein more fully described. I also claim attaching and combining with the powder magazine a double tube, or equivalent arrangement, by which articles may be conveyed into or from the magazine, without in any way exposing the interior of the magazine to fire from without; by which several arrangements a perfect security is effected against firing the magazines of vessels of war; all of which is fully described herein."

2. For an *Improvement in Lathes for Turning;* Hammond Doane and Allen Goodman, Dana, Worcester county, Massachusetts, November 6.

The patentees say,—"The nature of our invention consists in the arrangement of a series of cam patterns on a vertical shaft, in combination with the tool-stock of a lathe, to govern or guide the cutting tool, to produce two or more different patterns on circular wood, or other such works, on one piece, on the way of its length, such as upon such kinds of work as table legs, bed posts, &c."

Claim.—"What we claim as our invention, is the combination of the sliding cutter-stock, the friction wheel, and two or more patterns, the spindle, and the changing lever, substantially as herein described, and for the purpose set forth."

3. For an *Improved Arrangement of Engine for Using Steam Expansively;* John Ericsson, City of New York, November 6.

The patentee says,—"The leading feature of the new engine consists in the proportioning and combining its various parts in such a manner that the amount of force transmitted to the crank, during the first and second halves of its semi-revolutions, shall be alike, although the steam be expanded upwards of twenty times, and notwithstanding the extreme irregularity of such high degree of expansion."

Claim.—"What I claim as new, is placing the axis of the crank-shaft of single acting beam engines, in which the steam is applied expansively, nearer to a line parallel to the axis of the cylinder, and passing through the axis of vibration of the beam on the principle specified, and

for the purpose of obtaining a more regular mechanical action on the crank, by the application of the expansive principle of steam, as described.

"I also claim the employment of two single action expansion crank engines, with their cranks on one and the same shaft, and on opposite sides of the centre: that is, at an angle of 180°, substantially as described.

"And I also claim, in expansion engines, having two cylinders, with pistons moving in opposite directions, and connected with cranks on opposite sides of the centre, in one of which the steam acts by expansion alone; having one end of the large or expansive cylinder at all times in connexion with the condenser, and the other alternately in connexion with the condenser, and the steam end of the smaller cylinder, that the large piston, during its return stroke, may have a vacuum on each side, as described; when this is combined with the smaller cylinder connected with the boiler, and so arranged as to have both ends in connexion with one end of the larger or expansive cylinder, so that when the piston of the smaller cylinder is acted upon on one side by the steam, there shall be a vacuum on the other side, and when the steam is acting by expansion on the larger piston, it shall be in connexion with both ends of the small cylinder, as described. I do not wish to be understood as claiming the mode of connecting the small and the large expansion cylinders, when so arranged that the two pistons are connected and move together and in the same direction, for this was known before in what is known as the Leghwater Engine; but I do claim it when arranged as, and in, the combination herein specified.

"And thirdly, in combination with the two-throw crank shaft, having the two cranks on opposite sides of the centre, the making of the second of the two engines so connected of greater capacity."

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4. For *Improvements in Looms for Weaving Figured Fabrics;* Richard Garsed, Frankford, Philadelphia county, Pennsylvania, November 6.

The patentee says,—"My improvement consists of a combination of a pattern wheel directly with the heddles of a loom, and in the distribution and working of the patterns on said cylinder or wheel."

Claim.—"What I claim as new, is, 1st, operating the heddle frames by the direct application of a cylinder to them, substantially in the manner and for the purpose set forth.

"2d, I claim the mode of changing the pattern, by having several patterns on one cylinder, and, at each operation, turning the cylinder so far as to pass over the intermediate patterns, and bring the desired ones under the heddle frames, as above described.

And I also claim the apparatus for turning the cylinder, substantially as specified, whereby the cylinder can be turned through a greater or less arc as may be required, substantially as described."

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5. For an *Improvement in Mowing Machines;* Daniel K. and John K. Harris, Allensville, Switzerland county, Indiana, November 6.

Claim.—"What we claim as our invention, is the construction and use of the mortise or guide-slot, in combination with that for the axle of the driving wheel, for the purpose of allowing the wheel or thills, or both, to rise and fall without elevating or depressing the blades."

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6. For an *Improvement in Corn Shellers;* Carter, Harris & Carter, assignees of D. W. Harris and E. P. Carter, Yorkshire, Cattaraugus county, New York, November 6.

The patentees say,—"Our invention consists of a fluted feed roll, by which the ears of corn are fed into the sheller with their axes always parallel to that of the cylinder, and in a peculiar construction of the concave, by which the grains receive an oblique rub, which detaches them more easily from the cob."

Claim.—"What we claim as our invention, is constructing one or more of the bars of the concave in hinged sections, which turn in an arc whose axis is at right angles to that of the cylinder, whereby the ears are subjected to opposite and oblique rubs, which facilitate the stripping of the grains from the cobs.

"2d, Feeding the corn into the throat of the sheller by means of a fluted roll, which delivers the ears with their axes parallel to that of the cylinder, whereby the breaking of the cobs is prevented, and the shelling is expedited.

"3d, The employment of the hinged gate, to prevent the ears from being fed into the sheller either endwise or too rapidly."

7. For an *Improvement in Winnowing Machines;* A. J. Howell, Spruce Hill, Juniata county, Pennsylvania, November 6.

The patentee says,—"The nature of my invention consists in the peculiar mode of suspending and working the fans, by which I effect a more perfect separation of the seed from the chaff with the same amount of labor, than by any other mode with which I am acquainted."

Claim.—"What I claim as new, is the combination and arrangement of the horizontally sliding screen and shaking shoe, operated in the manner and for the purposes set forth."

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8. For an *Improvement in Regulators;* J. F. Mascher, Philadelphia, Pennsylvania, November 6.

The patentee says,—"The nature of this invention consists in dividing the rim or curb of a fly or balance wheel into two or more parts, the one being independent of the other, and making the wings of a fan movable, and attaching the divided parts of the fly wheel, and the fan wheels, to the shaft geared to the machinery of a clock, watch, musical clock or box, steam engine, or other machinery whose motion is to be regulated, by means of spiral or other springs, in such a manner as to admit of the divided parts of the wheel, and the wings of the fan, to recede from the centre of the shaft by centrifugal force, a sufficient distance to regulate the motion to the required speed; the former by inertia, and the latter by the increased resistance of the air to their surfaces in their passage through the same."

Claim.—"What I claim as my invention, is the combination and arrangement of the radial arms and arms C, arranged in pairs, spiral springs surrounding the same, fan wings and segments of a rim of circular curb, for regulating the speed of machinery, substantially in the manner herein set forth."

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9. For an *Improvement in Harness Hames;* Charles Pope, Syracuse, Onondaga county, New York, November 6.

The patentee says,—"My improvement consists in giving the inner edge of the hame a concave shape, which concavity (in the edge of the hame) corresponds with, and fits accurately to, the roll upon the collar."

Claim.—"What I claim as my invention, is the giving the inner edges of harness hames a concave form, for the purpose of enabling them to be fitted with much greater accuracy to the roll upon the collar, and thereby securing them against displacement, substantially as set forth."

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10. For an *Improvement in Rice Hullers;* D. H. Southworth and James R. Hitchcock, City of New York, November 6.

Claim.—"What we claim as our invention, is, 1st, the employment of rows of brushes on a rotating stock, in combination with a surrounding wire gauze cylinder, when the said rows of brushes or rubbers are made with their forward edges beveled, or with the equivalents thereof, substantially as described, whereby the entrance of the rice or other grains between the brushes and the surrounding cylinder is insured, as described.

"2d, The rows of inclined feeders or conductors, in combination with, and interposed between, the rows of brushes or rubbers, substantially as described, for the purpose of conveying the rice or other grain through the machine, as described; and this is claimed in contradistinction to inclined feeders and conveyors used at the end of the brushes.

"3d, The rubbers, made of India rubber, at the feeding-in end of the machine, in combination with the brushes, substantially as described, for the purpose of hulling the grain preparatory to the operation of the brushes.

"4th, The polishers, made of lambs' wool or other equivalent substance, at the delivery end of the machine, in combination with the brushes, substantially as described, for the purpose of polishing grain preparatory to its delivery, as described.

"5th, Connecting the brushes with the stock by adjustable means, substantially as described, for the purpose of adjusting the periphery of the brushes to the wire gauze cylinder, as described.

"And finally, Making the inclination of the face of the feeders or conveyors adjustable relatively to the axis, substantially as described, for the purpose of regulating the passage of the grain through the machine, substantially as described."

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11. For an *Improvement in Pendulum Balances;* Elnathan Sampson, Claremont, Sullivan county, New Hampshire, November 6.

The patentee says,—"The nature of my improvements in pendulum platform balances, con-

sists in the mode of arranging the levers for the platform, and adapting the pendulum balance thereto, so as to weigh either ounces or pounds with the same index and scale."

Claim.—"What I claim as new, is the combination of a pendulum balance, having a wing or fan attached thereto, to prevent its vibrations, substantially as described, with the adjustable counter-balanced platform for weighing, interposing the chain and cam in the manner set forth.

"I claim also, in combination with the above apparatus, the scale for small weights, so arranged, in connexion with the levers of the platform scales, as to have the same index indicate the weight of articles placed on either the large or small balance.

"And lastly, I claim the arrangement of the platform levers, both working in one direction, with the adjustable weight appended thereto."

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12. For an *Improvement in Seed Planters;* John W. Sherman, Ontario, Wayne county, New York, November 6.

Claim.—"What I claim as my invention, is the combination of the spring catch with the levers, substantially in the manner and for the purpose set forth.

"The combination of the device (consisting of the rod connected with the short arm of the lever) for opening and closing the register, with the devices for gearing and ungearing the seed roller, and raising and depressing the drill teeth, as described."

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13. For an *Improvement in Grease Boxes for Axles;* John M. Smart, City of New York, November 6.

The patentee says,—"In my improved railroad box, the semi-cylindrical box which rests on the journal is fitted to a cap-plate, provided with side flanches which embrace the semi-cylindrical box, and which are adapted to fit and slide within the sides of the lower half of the box or case, which is formed with a cavity for holding cotton waste or other fibrous substance, which, by capillary attraction, receives the oil and supplies it to the journal of the axles as it rotates, but this recess is surrounded by another cavity, that extends around the two sides and the outer end, to receive the oil, into which the ends of the cotton waste extend over to receive the oil and carry it over by capillary attraction. There is also a recess or cup at the inner end of the cup and under the enlarged part of the journal, which is also filled with cotton waste or other fibrous substance, to catch and retain all the oil which is carried over by the journal. The lower part of the case or box is connected and secured to the cup by means of two or more screw-bolts, which pass through appropriate ears, and which are tapped into the cap-plate, so that, by simply unscrewing these bolts, the lower parts of the case, with the oil and cotton waste, or other fibrous substance, can be removed and cleaned without the necessity of removing the axles from the cars, an operation which is indispensable with all other boxes, and which is attended with much labor and difficulty."

Claim.—"What I claim as my invention, is the auxiliary oil cup, which holds the cotton waste or other fibrous substance under the journal, when said combination is effected by means of the partitions, substantially as herein described."

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14. For an *Improvement in Carpet Cleaning Machines;* Joseph Wentworth, Palatine, Montgomery county, New York, November 6.

Claim.—"What I claim as my invention, is the application of the recoil strokes of elastic rods from tension, as described, to successive portions of a carpet or other fabric, moved over rollers in sliding frames, made adjustable by means described, by means of which the carpet or other fabric is rapidly and smartly beaten, and thereby cleansed from its dust and other impurities, and otherwise improved."

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15. For an *Improvement in Tailors' Measures;* James M. Whitham, Washington, Washington county, Pennsylvania, November 6.

Claim.—"What I claim as my invention, is the arms in the symmetrical rule, in combination with the dial plates, to which they are attached by pivot joints, as described."

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16. For an *Improvement in Apparatus for Raising and Carrying Water;* James D. Willoughby, Scotland, Franklin county, Pennsylvania, November 6.

The patentee says,—"The nature of my improvement consists in a carriage of peculiar construction, by which a bucket can be conveyed a long distance from the point where the

water is required, and lowered into a well, and returned to the operator, without requiring him to leave his post."

Claim.—"What I claim as my invention, is the arrangement and operation of the cord: that is to say, passing it round a pulley at or near the highest part of the track, substantially as set forth, whereby the carriage can surmount any elevation intervening between the well and the point where the water is to be delivered, without the use of a return cord."

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17. For an *Improved File Supporter;* Jerome B. Woodruff, Washington City, D. C., and Benjamin M. Townsend, Quincy, Adams county, Illinois, November 6.

The patentees say,—"Our invention consists of a stock, which embraces the saw, and is secured to it by clamp screws; the stock has an adjustable frame mounted upon one of its ends, which is furnished with a pair of parallel rolls by which the file is supported against the saw teeth, the pressure being given by a set of springs acting upon the adjustable frame."

Claim.—"What we claim as our invention, is the combination of the yielding guide rolls, for supporting a hand file during the operation of sharpening the teeth of saws, with the adjustable clamp-stock on which they are mounted, substantially as set forth."

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18. For an *Improvement in Fire Engines;* John B. Tarr, Albany, New York, November 6.

The patentee says,—"The nature of my invention consists in combining and arranging an auxiliary brake with a horizontal brake, in such manner that any required number of transverse parallel propelling rods can be attached to them, by which any desired number of hands can exert their physical power to the brakes in a standing position upon the ground simultaneously; thus doing away with the present modes of working the brakes from the top of the engine, which is not only excessively laborious, but limited as to the number of men who can apply their power simultaneously."

Claim.—"What I claim as my invention, is the combination of the horizontal vibrating brakes with the engine, said brakes being so constructed and arranged that any desired number of hands may conveniently apply their united power to the alternate action of the pistons, whilst standing upon the ground in parallel rows, at right angles to the sides of the engine; the handles or propelling rods being so connected with the brakes that they can be brought parallel with, and connected to, them, so as not to extend beyond the sides of the engine when the latter is not in use, by which the advantages enumerated are obtained."

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19. For *Improvements in Hemp Machines;* James Anderson, Louisville, Kentucky, November 13.

The patentee says,—"The purpose of my invention is to break and clean hemp or flax, and other fibrous substances, at one operation, or, in other word, by passing it once through the machinery for that purpose."

Claim.—"What I claim as new, is the combination of the grooved rollers, brake, and scutchers or scrapers, substantially in the manner and for the purpose set forth.

"I also claim the scrapers, when employed with any other feeder that shall hold the material firmly while being scraped."

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20. For an *Improvement in Pessaries;* Josiah B. Andrews, City of New York, November 13.

Claim.—"What I claim as my invention in the pessary, is the attachment of two stems by hinges to a circular rim, and which two stems may be combined into one stem with two branches, by means of a tube or socket to be slid upon the lower end thereof, in the manner fully set forth."

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21. For an *Improvement in Portable Water Closets;* Charles C. Bier, City of New York, November 13.

The patentee says,—"The nature of my invention consists in the construction and use of a pan working on a hinge, within the lower basin of a water closet, so as to be filled with water always when the closet is not in use, but emptied when used, by an arrangement of self-operating levers underneath the foot and seat of the closet; and also in the arrangement of a piston and cylinder under and beside the foot, and another on the under side of the closet-reservoir, operated upon by the levers above mentioned, for regulating the supply and cut-off of water at such times as is required for cleaning the closet."

Claim.—"What I claim is the construction and use of the arrangement of levers, in combination with, and operated upon by, the foot and seat boards of a water closet, for the pur-

pose of opening the pan in the lower basin or trap of a water closet, and regulating the supply of water to the closet-reservoir; also the construction and use of the levers, and weighted lever, in combination with the foregoing arrangement of levers, and operated upon by the seat board, for continuing the operation of supplying the water to the basins from the closet-reservoir."

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22. For an *Improvement in Cast Iron Car Wheels;* Thomas S. Bourshett, Little Falls, Herkimer county, New York, November 13.

The patentee says,—"The nature of this invention consists in casting the rim, arms, and enlarged part of the wheel surrounding the hub, hollow, of one uniform thickness, except where the parts join each other, and of a curved form, in such a manner as to allow each of the curved parts of the wheel to yield to the shrinkage, in case the other parts become fixed or cooled first, and the several parts to accommodate themselves to each other without danger of breakage in cooling;—the wheel thus formed being light and strong, and capable of bearing, without injury, the straining, racking, and twisting usually exerted on car wheels."

Claim.—"What I claim as my invention, is the combination of the curved hollow arms with the hollow rim, made semi-circular on its inner part, and hollow curved hub, enlarged and forming a continuation of the flaring of the inner ends of the arms, for causing all the parts of the wheel to accommodate themselves to each other in shrinking or cooling, substantially in the manner and for the purpose herein set forth."

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23. For an *Improvement in Binder Pulleys for Belts and Brakes;* Mertoun C. Bryant, Lowell, Middlesex county, Massachusetts, November 13.

Claim.—"What I claim as my invention, is, 1st, to communicate power to machines used for extracting liquids from other matter, by means of a movable binder pulley and a slack belt, the binder pulley being pressed upon the belt by means of a shifting weight, as described.

"2d, To attach to the same part to which is connected the binder pulley, the friction strap or break, so that, by the same movement that the binder is taken from the belt, the break is brought to act upon the machine, to stop it by the means described."

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24. For an *Improvement in Ice Cream Freezers;* Goldsmith Coffeen, Jr., Warren county, Ohio, November 13.

The patentee says,—"The nature of my invention consists in causing a blast of chilled air to permeate, be diffused through, and disturb, the liquids and materials of which ice cream is made. I chill the blast by drawing it from the atmosphere into a receptacle which is made to surround the sides and bottom of the vessel containing the ice or refrigerating mass; within this vessel the can containing the liquids and materials of which the ice cream is to be formed is placed, and the interval between the two packed with ice or the freezing compound. The air may be drawn off at a central opening in the bottom of the air chamber. A section of elastic hose is fastened in any usual way to the opening, and similarly attached at its other end to an ordinary double bellows mounted on a suitable frame."

Claim.—"What I claim, is freezing cream or other liquids by forcing through them currents of air, chilled by passing them through chambers artificially cooled, substantially as set forth."

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25. For an *Improvement in Seed Drills;* Daniel Custer, Southampton township, Franklin county, Pennsylvania, November 13.

Claim.—"What I claim, is the controling of the springs by means of the ring, in the manner and for the purpose set forth."

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26. For an *Improvement in Curling Hat Brims;* Francis Degen, City of New York, November 13.

Claim.—"I claim as new, 1st, the exclusive application of a changeable curler or former-piece, that entirely surrounds the hat crown and acts on the whole of the brim; and the combination therewith of the pieces *d*, yoke, swinging standard, cam, and lever, to hold a hat in such a manner that the workman may iron and finish the curl on the edges of the brim at one operation, effected substantially as described and shown.

"2d, The combination with the foregoing parts of the winch, lines, and hooks, to draw or turn the cloth on and over the edges of the hat brim, and turn the edges of the hat brim

over the edges of the curler-piece, and hold them there while the workman irons them, so as to set them in the required form, substantially as described.

"3d, I claim the application of the metal cooler-piece, for the purpose of cooling the hat brim so rapidly that the brim shall not have time to warp or change the form previously given to it; the shape of such cooler being conformable to the size and shape of the hat brim, so as to present an even bearing to the under side of the hat brim while cooling, substantially as described."

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27. For an *Improvement in Regulators for Water Wheels, &c.;* James Finlay, Cold Spring, Putnam county, New York, November 13.

Claim.—"I do not claim the conical drums, endless belt, and governor, these having been long known as a means of changing speed; but I claim as my invention the employment of these or analogous arrangements, in connexion with the loose cog wheel herein described, as the means of causing the revolution of said cog wheel to exceed or fall short of the revolutions of said water mill or first mover, whenever such water mill or first mover shall exceed or fall short of its proper speed. The consequence of this variation, through the agency of the screw, bell-crank, and movable plate, (which parts I also claim in combination with those above mentioned,) being either to enlarge or contract the jet apertures, and thereby to increase or diminish the speed of such water mill or first mover, in accordance with the necessities of the case; and this I claim under an arrangement substantially the same with that herein fully set forth, not intending, however, to limit myself to the particular form and connexion of the individual parts, but to vary these as I may find expedient, whilst I attain the same end by analogous means."

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28. For an *Improvement in Machinery for Turning Right and Left Lasts;* Charles Hartshorne and William B. Shaw, Gardiner, Kennebec county, Maine, November 13.

The patentees say,—"The nature of our invention consists in the arrangement and combination of certain mechanical devices by which, from a single reverse pattern, (say of a shoe last,) a corresponding pair of right and left lasts shall be produced simultaneously by the employment of a single rotary wheel of cutters, secured in a vertical adjustive frame, made to move longitudinally with a carriage, and having secured to its opposite end a tracing wheel, which bears against the reverse patterns, and causes the cutter wheel to be moved nearer to, or farther from, the centres on which the lasts turn, in a corresponding degree to the curvatures or inequalities of the surface of the reverse pattern touched by the tracer; the blocks from which the right and left lasts are to be formed being made to turn toward each other, and in contact with the cutters."

Claim.—"What we claim as our invention, is, 1st, the mode of cutting a right and left last, or other article, simultaneously from a single reverse pattern and two blocks of wood, by the before described combination and arrangement of a reverse model tracer wheel, and single wheel of rotary cutters, moving in opposite directions, the tracer wheel being in contact with the reverse model whilst the cutters turn between the two pieces of wood to be turned into a right and left last, the latter turning simultaneously in opposite directions inward and outward against the cutter wheel."

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29. For an *Improvement in Connecting Hubs to Axles;* John Kellogg, Madison, Lake county, Ohio, November 13.

The patentee says,—"The nature of my invention consists in so constructing the axle and interior portion of the hub, that the ordinary linch-pin or nut on the outer end of the axle is dispensed with, and the complete closing of the outer end of the hub, so that no tar or oil can escape, or sand or dirt find an entrance."

Claim.—"What I claim as my improvement, is the introduction of the rod, with the nib working into the cavity, in the manner and for the purposes herein set forth."

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30. For an *Improved Safety Sliding Breech Fire Arm;* J. B. Klein, City of New York, assignee of Charles Hartung, Beichlingen, Prussia, November 13.

The patentee says,—"The first part of my invention consists in adapting a sliding and turning breech-pin to a tube back of the barrel, and in a line therewith, in which tube it can slide and turn for the purpose of inserting and confining the charge in the barrel.

"The second part of my invention consists in fitting the movable turning and sliding breech-

pin to the breech of the barrel, by means of a screw-thread on the end thereof, and in the breech of the barrel.

"The third part of my invention consists in making the breech-pin tube with an inclined face, to act against a projecting part of the breech-pin, to force the breech-pin into the breech of the barrel, and to act as an abutment to resist the force of the discharge.

"The fourth part of my invention consists in locking the turning and sliding breech-pin, when inserted in the breech of the barrel, by means of a sliding bar, which prevents the said breech-pin from turning after the gun has been charged, whether this be used in combination with the screw-thread on the end of the breech-pin, and the inclined face of the tube in which the said breech-pin works, or either of them, or the equivalent of either or both of them.

"The fifth part of my invention consists in combining with the sliding breech-pin, and the punch by which the load is discharged, or the carrier thereof which slides in the breech-pin, a spring-catch, to hold the punch back during the operation of charging the barrel; and this part of my invention also consists in combining this method of holding back the discharging punch with the connexion of the said punch or its carrier with the trigger, whereby the trigger can only act to liberate the discharging punch after it has been liberated by the catch of the breech-pin.

"The sixth part of my invention consists in combining the sliding bar, which locks and unlocks the breech-pin with the catch of the breech-pin, which locks and unlocks the discharging punch, by means of which combination the two operations are effected by the same movement.

"And the last part of my invention consists in making cartridges with a solid cylinder of papier maché, or other equivalent substance, with a recess at the forward end for the ball, and one at the back to receive the priming, the same being so enveloped as to have the charge of powder back of the priming."

Claim.—"What I claim as my invention, is, 1st, the method of locking the breech-pin, when inserted, to prevent it from turning, by means of the sliding bar, susbstantially as described; and this I also claim, in combination with both or either of the methods of securing the breech-pin by the screw-thread and the inclined face of the breech-pin tube, substantially as described.

"2d, Combining with the sliding breech-pin, and the discharging punch which slides therein, or the carrier thereof, the spring-catch for holding the punch back during the operation of loading, substantially in the manner and for the purpose specified. And I also claim this method of holding the discharging punch, in combination with the connexion of the punch, or the carrier thereof, with the trigger, substantially in the manner and for the purpose specified.

"3d, The combination of the sliding bar, which locks and unlocks the breech-pin with the catch of the breech-pin, which holds and liberates the discharging punch, substantially in the manner and for the purpose specified."

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31. For an *Improved Means of Changing the Combination in Revolving Tumbler Locks;* Lewis Lillie, Troy, New York, November 13.

The patentee says,—"The nature of my invention consists of a mode of securing the auxiliary bolt, which enters a recess in the main bolt, to secure it when thrown out, by means of a series of rotating tumblers, notched on their periphery, so that the auxiliary bolt can only be liberated when the notches of all the series of rotating tumblers coincide. My invention also consists in varying the series of notched tumblers in a hinged or vibrating frame, and making their outer peripheries with cogs, and combining them with a series of corresponding cogged tumblers connected with the stationary back plate, so that, when the frame of the notched series is elevated or vibrated sufficiently to disengage the cogs, the other series will be free to rotate, so that the combination may be varied at pleasure to suit any variation in the key, and whilst the key is in place, the vibrating frame may be let down to insure the adjustment of the parts.

"And my invention also consists in operating the main bolt, to throw it in and out, by the rotation of a plate back of the combination tumblers, by having the said plate connected by a joint link with the main bolt."

Claim.—"What I claim as my invention, is hanging the series of rotating tumblers in a hinged or vibrating frame, their outer periphery being provided with cogs, which gear into the cogs of the series of tumblers connected with the stationary lock-plate, so that, when the said frame is elevated, the tumblers of the other series will be free to turn, in order to suit any variation in the set of the key."

32. For an *Improved Method of Fitting the Heaving Socket and Head of Windlasses;* Chas. Perley, City of New York, November 13.

Claim.—"I claim as of my own invention, as new and useful in effect, the application of the boss, with the wrought metal band and square, acting with the bush, to connect the windlass head with the shaft, and at the same time support the heaving socket and flanch, in such a manner that either the head or the heaving socket and flanch, or both, can be immediately replaced when injured: the whole constructed and operating substantially as described."

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33. For an *Improvement in Machinery for Splitting and Dressing Rattans;* Sylvanus Sawyer, Templeton, Worcester county, Massachusetts, November 13.

Claim.—"What I claim as my invention, is the principle and combination of the vibrating cutter and guide; to use any number required to remove the whole surface of the cane or rattan, dividing the surface into any required number of strands."

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34. For an *Improvement in Leather Dressing Machines;* Charles Slawson, Norwich, Chenango county, New York, November 13.

The patentee says,—"The nature of my invention consists of the passing of the tanned hide or leather over an endless adjustable apron, and beneath a spreader, and between adjustable revolving rollers, by which means I am enabled to scrape, compress, smooth down, and make even the surface, and more compact the body, of the tanned skin, and thus prepare the leather for its completing and finishing processes, in a more expeditious and better manner than under the older and more usual methods and means now in use."

Claim.—"What I claim as my invention, is, 1st, the adjustable endless apron, in combination with the scraper or extender, for the purpose and uses as herein described; and

"2d, I claim the adjustable scraper or extender, as described, for the purposes and uses of leather dressing, as herein set forth."

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35. For an *Improvement in Brick Presses;* Ferdinand Zizemann, St. Louis, Missouri, November 13.

The patentee says,—"The nature of my invention consists in the manner of increasing the pressure on the clay whilst in the moulds, (formed in the periphery of the moulding wheel,) as the pressing wheel descends, by diminishing the distance between the peripheries of the moulding and pressing wheels, by causing the pressing wheel to descend in the arc of a circle of a radius greater than the semi-diameter of the moulding wheel, and scribed from a different centre.

"Also, in a peculiar construction of an apparatus for distributing fine sand or dust over the moulds, before receiving the clay, to prevent the bricks adhering to their surfaces, so as to allow of their being discharged without breakage at the corners, or any part of their surfaces.

"Likewise in a novel mode of returning the pistons (which also serve as the bottoms of the moulds whilst moulding) to the bottoms of the moulds, by means of a rotary toothed wheel, combined with the moulding wheel, by which it is turned without the aid of any connecting cogged or hand gearing."

Claim.—"What I claim as my invention, is, 1st, the combination of the revolving conical duster with the rotating moulding and pressing wheels, constructed, arranged, and operated in the manner and for the purpose herein set forth.

"2d, I also claim the combination of the rotary toothed wheel with the moulding wheel, for driving the pistons to the bottom of the moulds, after the bricks are discharged therefrom, constructed, arranged, and operated in the manner and for the purpose herein described; said wheel being turned by the action of the moulding wheel in contact therewith, without the aid of any connecting cogged or hand gearing.

"3d, I also claim the manner of increasing the pressure on the clay whilst in the moulds, to form the brick, by diminishing the distance between the peripheries of the moulding and pressing wheels, by causing the pressing wheel to descend in the arc of a circle (13) of a radius greater that the semi-diameter of the moulding wheel, the bearings or boxes of the axle of the pressing wheel being secured to the parallel beams, whose outer ends are made to rise in the arc of a circle, concentric to the arc (13), by means of vertical screws arranged to bear against the under sides of said beams, to raise or lower the pressing wheel, in order to increase or diminish the pressure on the bricks in the moulds, as aforesaid."

36. For an *Improvement in Chronometers for Longitude;* John Sheldon, Millville, Cumberland county, New Jersey, November 20.

Claim.—"What I claim as my invention, is the dial with four hands, which are at right angles to each other, and revolve once in 24 hours; said dial being divided into hours and degrees, substantially in the manner and for the purposes described."

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37. For an *Improvement in Ox-Yokes;* John Chase, Craftsburg, Orleans county, Vermont, November 20.

Claim.—"What I claim, is the pinion, and rack-bars working within the beam, in the manner and for the purpose set forth.

"2d, I also claim the two iron plates, as set forth. I also claim the grooves and tongue, in the manner and for the purpose set forth."

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38. For an *Improvement in Scythe Snaths;* Luther Cole, Lafayette, Onondaga county, New York, November 20.

The patentee says,—"The nature of my invention consists in curving forward that portion of the scythe snath below the right nib or thole, to such an extent as to form an obtuse angle between the scythe and snath at the point where they are joined, and also in such a manner as to equalize the labor between the right and left hands; whereas, in snaths now in use, the greatest amount of labor falls upon the right arm."

Claim.—"What I claim as my invention, is curving forward that portion of the snath behind the right hand nib or thole, and the extremity to which the scythe is attached, in such manner as to form an obtuse angle between the scythe and snath at the point where they are joined, by which device the left hand and arm are extended forward, previous to the scythe's entering the grass, so that the labor of cutting is performed as much by drawing in the left arm as by forcing around the right, at the same time the position given the scythe allows it to cut the whole length, and is more easily sharpened at the heel with the rub-stone than scythes hung on ordinary snaths."

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39. For an *Improved Auger for Boring Earth;* Ashley Crafts and Ebenezer Weeks, Auburn, Geauga county, Ohio, November 20.

Claim.—"What we claim as our invention, is the peculiar construction of the auger, namely, the combination of the spiral lip or shelf, extending the whole, or nearly the whole, length of the spiral twist, with the said spiral twist, which is made to approach the centre gradually till it intersects the shaft or stem, forming an auger of a shape approximating to that of a frustrum of a cone, and being entirely open at the lower end."

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40. For an *Improvement in Distilling and Rectifying Spirits;* Carl Falkman, Stockholm, Sweden, November 20; anté dated August 5, 1848.

Claim.—"What I claim as my invention, is the method of purifying and rectifying spirits, or giving any desired scent or flavor thereto, by causing the vapor of spirits to pass through a partial cooler containing the required substances for purifying, rectifying, and impregnating it, substantially as described, whereby the vapor of spirits, in passing through the said apparatus, under the combined action of partial cooling, is concentrated and purified, and separated from water and the substances employed for imparting odors or flavors, as described; and this I claim, irrespective of the kind of substance or substances, separately or connectedly, which may be used for producing the chemical effects on the spirit vapor."

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41. For an *Improvement in Machines for Moulding Bricks;* John W. Frost, Croton, Westchester county, New York, November 20.

Claim.—"What I claim as my invention, is the combination of the slotted bar with the levers, pin or bolt, cranks secured to the transverse shafts, connecting-rods attached to the presser, and cogged sector and rack on carriage, for causing the presser to be raised in the moulding-box, simultaneously with the movement of the filled moulds from under the moulding-box, substantially as set forth."

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42. For an *Improvement in Ink Fountains;* Elijah Jordan, West Cunningham, Hampshire county, Massachusetts, November 20.

The patentee says,—"The nature of my invention consists in the combination of an ink

fountain or reservoir with a steel pen, a peculiar tracing pen, and a hair pencil, constructed in two parts or sections, one to fit on the other, and having in the lower part a suspended needle or pin, to act as a guide or gate; the object of the ink fountain and the connected parts being to carry a large supply of ink or other marking fluid, for writing continuously a long time, without replenishing the pen or dipping it into the ink in the ordinary way, and to regulate the flow just as it is required in writing or marking."

Claim.—"What I claim as my invention, is the mode of supplying the pen or marking instrument with ink, by the pen or marking instrument acting upon the valve or stopper of the ink fountain, to allow the ink to ooze out of the same when in the act of writing or marking, in the manner substantially as described."

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43. For an *Improvement in the Combined Table and Bedstead;* Frank Leslie, Upper Rahway, Essex county, New Jersey, November 20.

Claim.—"What I claim as my invention, is, 1st, the table leaves, in combination with the folding side pieces, for converting a dining table into a bedstead, as described.

"2d, I claim the middle leaf with flolding legs, in the manner and for the purposes described.

"3d, I also claim the construction and use of the movable towel frame, in combination with the head board, as described.

"4th, I also claim the construction of the apparatus for washing-stand and ottoman or support on the table, as described."

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44. For an *Improvement in Seed Drills;* Jacob Mumma, Hummelstown, Dauphin county, Pennsylvania, November 20.

The patentee says,—"The object of my invention is to secure an equal distribution of seed in the drills, either in ascending or descending hills, to regulate the exact quantity sown per acre, and to distribute the seed in the drill, so that it will be more perfect in its growth, and yield more than those in ordinary use."

Claim.—"What I claim as new, is, 1st, the combination of the plain pulleys, mouth-pieces, and slides, operating as set forth, for regulating the discharge of the grain.

"2d, I claim the conical plates at the lower end of the tubes, for distributing grain."

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45. For a *Process for Making Malleable Iron Direct from the Ore;* Moses S. Salter, Horace Norton, and John W. Poinier, assignees of Moses S. Salter, Essex county, New Jersey, November 20.

Claim.—"What I claim as my invention, is the process of manufacturing iron directly from the ore, in a furnace composed of three combined chambers, one above another, all actuated by the same fire, whereof the upper chamber is used for heating and deoxidizing, the middle chamber for fluxing and working, and the lower chamber for reducing and finishing the iron, substantially in the manner and for the purposes set forth."

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46. For an *Improvement in Connecting Hubs with Axles;* Elnathan Sampson and A. M. Billings, Claremont, Sullivan county, New Hampshire, November 20.

Claim.—"What we claim as our invention, is the fastening a wheel hub to its axle, by means of an annular groove near the extremity of the axle journal, and a sliding retaining plate, and a spring guard pin, placed within the cap, made fast to the outer end of the hub, to wit, a curved portion of the said retaining plate being forced by the spring into the groove in the axle journal, and securely retained, when in that position, by the spring guard pin, substantially in the manner set forth."

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47. For an *Improvement in Hemp Brakes;* Augustine Smith, Mobile, Alabama, November 20.

Claim.—"What I claim as my own invention in the above described circular indented platform mill, with horizontal surface, is the circular indented platform, with the application of the bevel indented roller or rollers on this horizontal indented platform, which gives a coarser and a finer break to suit any thickness of stock, from the coarsest hemp to the finest and most delicate flax, and that it is capable of being extended to any diameter, to receive any number of rollers of any desired weight, and to do any amount of business by the application of any motive power; and the model is intended to show simply the form and position of the bars on the platform, and the form and application of the rollers, viz., it is only intended

to show the principle, and not the mechanism or most convenient mode of application, as the mechanism and mode will vary in almost every instance."

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48. For an *Improvement in Sounding Boards for Piano Fortes;* Richard Swan, Jr., New Bedford, Bristol county, Massachusetts, November 20.

The patentee says,—"The nature of my invention consists in the attachment of a sounding case to the under side of the sounding board of a piano, and the making a suitable number of openings in the sounding board, for the escape of the sound from the case, for the purpose of adding power and sweetness to the tone of the instrument."

Claim.—"What I claim as my invention, is the combination of a sounding case with the ordinary sounding board of a piano, (suitably perforated with sound openings,) substantially in the manner and for the purposes set forth."

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49. For an *Improvement in Welt Cutting and Splitting Machines;* John E. Tucker, Suffolk county, Massachusetts, November 20.

Claim.—"I therefore claim the combination and arrangement of the two short cylinders, the knife, and chisel, arranged at one end of an ordinary leather-splitting machine, substantially in the manner and for the purpose of forming strips of leather, and cutting them into welts, at one and the same time; and from larger pieces of leather, as specified."

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50. For an *Improvement in Curvilinear Saw Mills;* Thomas Dugard, City of New York, November 20.

The patentee says,—"My improvements relate to that class of saw mills in which the saw is made to vibrate on its axis, and to move laterally, that it may be guided to cut curved and diagonal lines; and the first part of my invention consists in hanging the saw gate to slide vertically between finger posts connected together, and which can be made to slide horizontally, to give the lateral movements to the saw, by means of rack and pinions connected with a hand wheel within the reach of the attendant.

"This part of my invention also consists in connecting the pitman or pitmen with the saw gate, by means of a horizontal rod or rods attached to the gate, which slide in a hole in the end of the pitman or pitmen, to allow of the lateral movements of the saw gate, the upper end of the pitman or pitmen being governed by a guide or guides.

"And the second part of my invention consists in vibrating the saw by means of a crank-handle, or the equivalent thereof, on some stationary part of the frame of the mill, by combining this with a pulley or pulleys, or the equivalent thereof, on a rock shaft or shafts in the saw gate, which slides through the said pulley or pulleys by a feather or its equivalent, the said rock shaft or shafts being connected with the stirrups of the saw. And this part of my invention also consists in combining a vibrating guide, which embraces the saw, and through which it slides, with the rock shaft or shafts, that the saw may be guided and kept in the required position near its point of action on the timbers."

Claim.—"What I claim as my invention, is hanging the saw gate to slide in fender posts, framed together and sliding horizontally to give the required lateral movements to the saw, substantially as described, when this is combined by rack and pinion with a shaft and hand wheel, or the equivalent thereof, under the control of the attendant, substantially as described.

"I also claim, in combination with the above described method of hanging the saw gate, to give it the required lateral movements, connecting the pitman or pitmen with the saw gate, by means of a horizontal rod or rods on the saw gate, and governing the upper end of the pitman or pitmen by a guide or guides, substantially as described.

"I also claim the method, substantially as herein described, of vibrating the saw by means of a rock shaft or shafts connected therewith, and hung in the saw gate, in combination with the pulley or pulleys, or the equivalent thereof, through which the shaft or shafts slide, as described; the said pulley or pulleys, or the equivalent thereof, being combined with a crank-handle, or its equivalent, on some stationary part of the framing, as described.

"And finally, I claim, in combination with the rock shaft or shafts, the vibrating saw guide connected therewith, substantially in the manner and for the purpose specified."

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51. For *Improvements in Flood Gates for Fences;* S. D. Hopkins, Brookville, Albemarle county, Virginia, November 20.

Claim.—"I do not claim the barrel, rollers, and pulley, as my invention when used separately, but what I do claim as my invention, is the combination of all the parts with the

framework above described, so combined and applied as to produce the self-working flood gate, as above described."

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52. For an *Improvement in Sofa Bedsteads;* John A. Robson, City of New York, November 20.

The patentee says,—"The nature of my invention consists in sliding the seat of the sofa out to the front, and dropping the upholstered part of the back, which is the same on both sides, out of the frame and towards the front, meeting and resting against the inner edge of the seat, thus forming a double spring mattress bed."

Claim.—"What I claim as my invention, is the letting of the upholstered part of the back fall forward, to meet and rest against the rear or back edge of the seat to form the bed, without moving the sofa from its place, or disturbing any part of the frame, as described."

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53. For a *Combination of a Double Traveling Hearth with a Blast Furnace;* Lorenzo Sibert, Woodstock, Shenandoah county, Virginia, November 20.

The patentee says,—"My improvement is for the purpose of converting iron directly from the blast furnace into malleable iron, by a peculiar construction of the furnace, whereby I am enabled to keep up the heat in the blast furnace without interruption while decarbonizing the iron."

Claim.—"What I claim as new, is the combination of the double traveling hearth with a blast furnace, in the manner and for the purpose as set forth."

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54. For an *Improvement in Platform Scales;* Thaddeus Fairbanks, St. Johnsbury, Caledonia county, Vermont, November 20.

Claim.—"What I claim as new, is the combination of the pivot or bearing frame, or primary platform, the blocks of rubber or spring contrivances, and the superior platform with the weighing levers or mechanism; the whole being substantially in the manner and for the purpose as specified."

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55. For an *Improvement in Machines for Folding Paper;* Jas. H. Gray, Springfield, Hampden county, assignee of Edward N. Smith, West Brookfield, Worcester county, Massachusetts, November 27.

The patentee says,—"My invention consists in a series of moving plane surfaces, one above the other, framed of endless bands, on which the paper is extended, and by which it is carried through the machine."

Claim.—"What I claim as my invention, is folding sheets of paper or other flexible substance by machinery, made and operated substantially upon the principle herein set forth: that is to say, by striking the paper or other substance upwards in the line in which the fold is to be made, from a surface on which it has been extended, and seizing it between converging surfaces which complete the fold and deliver the folded paper, irrespective of the number or forms of the surfaces employed, and of the number or forms of folding edges required to give the requisite number of folds to the paper, irrespective, also, of the arrangements and devices for operating the several members of the machine."

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56. For an *Improvement in Flour Bolts;* George W. Brown, Jackson, Jackson county, Michigan, November 27.

The patentee says,—"The nature of my invention consists in reversing the order of bolting, running the meal over the coarse cloth first, using wire instead of coarse cloth, thereby preventing any and all hard substances from passing over the surface of the superfine cloth, allowing nothing to pass out to the superfine cloth except the flour and middlings; and also the use of zinc or other metallic substance in and about the reel, chest, and spouts, for the purpose of cooling the flour after it is separated from the bran and shorts; also the use of one cloth inside of the other upon the same reel, and round arms and three square ribs."

Claim.—"What I claim as my invention, is the arrangement of the bolting cloths upon a reel of any convenient construction, in such manner as to run the meal over the coarse cloth first, and the use of zinc or other metallic substance in and about the bolts, to operate as a cooler upon the flour after it is separated from the bran and shorts."

57. For an *Improvement in Butter-Working Machines;* Elias H. Merryman, Springfield, Sangamon county, Illinois, November 27.

Claim.—"What I claim as my invention, is the use of two or more rollers, with adjustable scrapers held in contact with the rollers by springs or other devices, operating in a vat of running water, to wash butter, and separate the broken capsules, cheesy matter, butter-milk, and other impurities, by dissolving those that are soluble in water, and washing away those that are not soluble, substantially as described; the water being let into the vat from a cistern above the level of the vat, and escaping at the spout on a level with the journals of the rollers."

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58. For an *Improvement in Brick Presses;* Arad Woodworth, 3d, Worcester, Worcester county, Massachusetts, and Samuel Mower, Philadelphia, Pennsylvania, November 27.

Claim.—"We are aware that the mere employment of a ram or falling weight to produce density is not new; consequently we do not claim such, nor do we claim as our invention the combination of the percussion ram and its piston, (whether connected to it or separated from it,) the brick-mould, and lower expulsion piston; the whole being made to operate in such manner on clay in the mould as to compress said clay, and afterwards expel it from the mould; but we do claim, as auxiliary thereto, and in combination therewith, machinery for holding the ram and its piston stationary, just subsequent to its first blow, and elevating the lower piston in the mould, in order to produce direct compression on the lower face of the brick, in manner and for the purpose as above stated, the machinery employed for such purpose being the forked slide bar, its projection, the projection on the ram, and the cams which operate the slide bar and lower piston, as specified.

"We wish it understood that we make no claim to a sliding mould-charger, in connexion with a mould and hopper, as constructed and made to operate prior to the date of our invention; but what we do claim as our improvement, is to so construct and use the sliding charger, in connexion with the ram piston, as above specified, as to render it (the said charger) a part of the mould during, and for some time after, the first percussion of the ram, the same being for the purpose of attaining certain advantages we have above maintained.

"We further claim the weighted or spring scraper, in its combination with the carriage and the mould plate, and for the purpose of cleaning the top surface of the mould plate, as described.

"We also claim to so construct the mould with the flaring or inclined sides, and combine them with mechanism for lifting the brick a short distance just previous to the second percussion, as specified, as to not only enable the brick to be freed in a measure from its adhesiveness to the mould, but to permit the compressed air, or part of the same, in the immediate vicinity of the surface of the edges of the brick, to escape as explained; the diminution of adhesiveness tending to lessen the friction of the clay against the sides of the mould under the second percussion of the ram."

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59. For an *Improvement in Processes for the Manufacture of Sugar;* John Scoffern, Upper Holloway, England, November 27; anté dated December 8, 1847.

The patentee says,—"My invention consists of the employment of sulphurous acid as a means of separating lead used for purifying or removing coloring and other foreign matters from solutions containing sugar."

Claim.—"What I claim, is the combined use of sulphurous acid with lead, in the manufacture and refining of sugar, substantially as set forth."

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60. For an *Improvement in Railroad Trucks;* Jno. F. Rogers, Troy, New York, November 27.

The patentee says,—"The nature of my invention consists in arranging spiral springs within pockets or tubulated casings, and confining said pockets and the journal box into one piece, in such a manner as that the weight of the car shall act upon the springs. I also combine spiral springs in the balance beam within similar pockets, in such a manner as to support the body of the car thereon. In this arrangement of trucks each wheel, in its vertical action, is free from the other wheels of the car, and possesses great lateral stiffness, and is a cheaper mode of construction than any other with which I am acquainted."

Claim.—"What I claim as new, is the arrangement and combination of the journal boxes with the spring casings or pockets, through which bolts are affixed to the frame, and acting as guides to the boxes; the whole being constructed and arranged in the manner and for the purpose substantially as specified."

61. For *Improvements in Machinery for Dressing Flour;* Charles Learned and Stephen Hughes, Indianapolis, Marion county, Indiana, November 27.

The patentees say,—"The nature of our invention consists in separating the fine flour that usually is found adhering to the bran after passing through the flour bolts, and which is usually lost to the superfine barrel, by conducting the bran by an inclined spout through the eye of an upper revolving cylinder of metallic beaters, to a space between it and a lower revolving cylinder of beaters, turning in an opposite direction, where it is struck by a number of concentric rows of four-sided metallic teeth, projecting vertically from the adjacent surfaces of the two opposing cylinders, and separated from the bran, and driven by centrifugal force against a stationary cylindrical bolting cloth, surrounding the revolving cylinders, through which the flour is driven, aided by a current of air, gathered into, and passing down through, the shaft of the upper cylinder, (which is made hollow and suspended by a neck,) to the space between the cylinders; the flour being collected in a scroll-shaped chamber surrounding the cylindrical bolt, which gradually enlarges in its circuit to the outlet, where the flour is discharged, in a tangential line to the circle of the cylinder bolt, in a suitable conducting spout, whilst the bran and flour that failed to pass through the cloth above, are again acted on by the radial wings affixed to the under side of the lower cylinder, causing the remaining flour to pass through the cloth into the scroll space, whilst the bran descends to the bottom of the cylinder bolt, in which there is a discharge opening, through which it passes to a proper receiver; the aforesaid cylinders being turned by bands and pulleys, connected with any suitable and adequate propelling machine, at the rate of about 800 revolutions per minute."

Claim.—"What we claim as our invention, is, 1st, the employment of a revolving hanging disk of concentric rows of metallic polygonal beaters or cutters, and central hollow suspended shaft, made with curved induction and eduction branch tubes; said hollow shaft serving a double purpose of a hanging shaft and air conductor, for conveying streams of air to the space between the cylinders, in combination with a revolving disk turning in a contrary direction, also armed with concentric rows of metallic polygonal beaters and cutters, and radial wings, arranged and operating in the manner and for the purpose herein fully set forth.

"2d, We also claim the employment of the helical plate, in combination with the cylindrical bolt, for producing the gradually enlarged space into which the flour is received, and from which it is discharged, in the manner herein described."

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62. For an *Improved Form of Teeth in Harvesting Machines;* Eliakim B. Forbush, Buffalo, New York, November 27.

The patentee says,—"The nature of my invention consists in making an open triangular tooth, of any required base and perpendicular, or, in other words, a triangular hollow tooth, which will vibrate with less friction, and clear itself, guard fingers, and case, from all obstructions, when used in reaping or mowing machines."

Claim.—"What I claim as my invention, is an open triangular tooth, or triangular hollow tooth, for cutting grass and grain, with its results, as described."

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63. For an *Improvement in Instruments for Milking Cows;* Cyrus Knapp, City of New York, November 27.

The patentee says,—"The nature of my invention consists in the making of a sack or pocket of gutta percha, or other suitable material, for the purpose of encasing the teat of the cow. In the lower end of it is secured a small silver tube, through the orifice of which is inserted a gutta percha piston or exhauster. This tube and piston (when the sack is applied to the teat) is passed into the milk duct, when the piston is withdrawn, leaving the orifice of the tube open for the discharge of the milk, in consequence of the artificial warmth, like that of the mouth of the calf, created by the impervious sack, and pressure of the band encircling the neck of it and the teat."

Claim.—"What I claim, is the sack made of any suitable material, (gutta percha is preferable however,) in combination with the elastic strap, for compressing the teat and neck of the sack, and the exhauster tube and piston, in form and manner and for the purposes herein substantially set forth."

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64. For an *Improvement in Blank Account Books;* Charles Hopkins, City of New York, November 27.

The patentee says,—"The first part of my invention consists in uniting together the blank leaves and inner covers, and uniting them on each side of the back with a strip of metal, or other suitable material, formed with hinged knuckles, when this is combined with the outer

cover or binding made separately, and also provided with corresponding hinge-strips at the inside of the back, so that the cover can be attached to, or detached from, the book, by simply uniting the hinge-strips of the book and cover, by means of rods of wire passing into the eyes or loops of the hinge knuckles.

"And the second part of my invention consists in making the book into sections, each section being bound separately, and provided with hinged strips, such as above indicated, so that the several sections can be connected together or separated, and also connected with, or disconnected from, the outer cover or binding, whereby a continuous ledger or account book may be made, the several sections, as they are filled up, being removed, and other sections put on."

Claim.—"What I claim as my invention, is connecting the leaves of a book with the cover, by means of hinged strips attached to the back of the book and to the cover, so that they can be connected or disconnected, by means of wires passing through the eyes or knuckles of the hinge-strips, substantially as described, whereby the book can be disconnected from, or connected with, the cover, as described.

"And I also claim making a book in sections, when the sections are provided with hinged strips, substantially as herein described, so that they can be connected with, or disconnected from, each other and the cover, substantially as described."

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65. For an *Improvement in Rotary Pumps;* Peter Sweeney, Buffalo, New York, November 27.

The patentee says,—"My invention consists in constructing the revolving piston in such manner that it shall yield to, and pass by, any obstruction which may lodge in its passage through the pump chamber, and which would otherwise injure the pump. Likewise, in so connecting the valves with a double cam wheel that they shall be raised at the proper time to allow the piston to pass, this cam wheel being made heavy, so as to serve also the purpose of a fly wheel."

Claim.—"What I claim as my invention, is the construction of each arm of the piston in such manner that, while it is ordinarily kept in its proper position by the pressure of the water, its lower edge will yield to, and pass over, an obstruction which would otherwise break the pump."

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66. For an *Improvement in Glazing Pottery Ware;* Christopher W. Fenton, Bennington, Bennington county, Vermont, November 27.

Claim.—"What I claim as my invention, is the coloring of the glaze of pottery ware by means substantially as set forth and described."

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67. For an *Improvement in the Combined Plough and Seed Planter;* William Croasdale, Hartsville, Bucks county, Pennsylvania, November 27.

The patentee says,—"The nature of my invention consists in so constructing a feeding apparatus (without the usual frame, handles, beam, cultivator and tubular teeth, covers, &c.) as to become an attachment of a common single furrow plough, by which the seed can be sown simultaneously with the first or second ploughing, and by which the expense of one ploughing is saved, and the apparatus adapted to strong, stumpy, and other rough land, where the ordinary wheeled seeding machine, containing a combination of cylinders and tubular teeth, cannot be used, and by which the larger and expensive machinery now employed as a separate machine can be dispensed with."

Claim.—"What I claim as my invention, is the construction of the seed planter, as described, consisting of a seeding apparatus, combined with a single furrow plough, as described, so as to sow the grain at the first or second ploughing, in the manner and for the purpose herein fully set forth."

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68. For an *Improvement in Boring Machines;* James H. Aldrich, Portsmouth, Rockingham county, New Hampshire, November 28.

Claim.—"What I claim as my invention, is the combination of three principles, namely, 1st, the manner in which the bed-piece, to which the carriage is connected, is raised or lowered, as above described; 2d, the manner in which the bed-piece may revolve, to set the auger at any angle or degree; 3d, the manner in which the auger is withdrawn by the direct motion of the crank."

69. For an *Improvement in Stop-Cocks and Filters in Combination;* Abraham and Henry Johnson, City of New York, November 27.

Claim.—"What we claim as our invention, is an improvement on the filtering cock secured to us as aforesaid, and is the arrangement of the water passages in the central pipe, in combination with the filters having two chambers, with a water passage leading from each chamber, and a recess, substantially as described, whereby filtered or unfiltered water can be drawn, and the filtering action reversed as described."

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70. For *Improvements in Machinery for Twisting Shawl Fringe;* Bay State Mills, assignee of Milton D. Whipple, Lowell, Massachusetts, November 27.

Claim.—"What I claim as my invention, is, 1st, dividing the yarns into proper quantities for the formation of the two strands, by means of the dividing plates and separator, shaped, and made to slide up and down, substantially as set forth.

"2d, I claim twisting the two strands separately at first and then together, by means of the twisting finger or rubbers, constructed and arranged so as to turn inwards and outwards over each other, one above and the other below the yarns, substantially as set forth.

"3d, I claim the peculiar construction and arrangement of the separator, as I have termed it, so that it may open over the rubbers, and drop down just before the two strands are to be twisted together, substantially as described.

"4th, I claim a machine for twisting the fringes of shawls, &c., having a stretching frame, dividing plates, and separator, twisting fingers or rubbers, combined and operated successively as hereinbefore specified and described."

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71. For an *Improvement in Machinery for Dressing Barrel Heads;* Timothy Shepard, Oswegatchie, St. Lawrence county, New York, November 27.

The patentee says,—"The nature of my invention consists in providing a way for turning the face or top of the head, and the edge and bevels of the same, at the same operation."

Claim.—"What I claim as my invention, is the application of the shield, with the orifice and rest attached to the same, in combination with the plane to prepare the large bevel."

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72. For an *Improved Method of Regulating the Blow-Off Valve of Steam Boilers;* Charles W. Copeland, Brooklyn, New York, November 27.

The patentee says,—"My invention consists in improvements in the method of discharging that portion of the water from the boilers of steam engines known as the 'blow-off' water."

Claim.—"What I claim as my invention, is regulating the blow-off water by the action of the feed water, so that said blow-off water will always bear a certain proportion to the quantity fed, which ratio must vary according to circumstances, and so as to cease entirely when the feed ceases to enter the boiler.

"2d, I claim the combination of the blow-off valve with the check valve, in such manner that the blow-off valve will be operated by the stem of the check valve; the whole being arranged and constructed substantially in the manner and for the purpose set forth."

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73. For an *Improvement in Propellers;* John Patch, Boston, Massachusetts, November 27.

The patentee says,—"The nature of this invention consists in attaching to a horizontal shaft, passing through a stuffing-box in the stern part of the vessel, on either side of the rudder, a sufficient distance below the surface of the water, four spiral segmental plates, arranged in reverse positions and connected together at their outer extremities, in such a manner that when said shafts are revolved with a proper degree of speed, the surfaces of the spiral segmental plates will be caused to strike the water at such an angle with the line upon which the vessel moves, as to cause the vessel to be forced or propelled forward with a speed commensurate with the size of the spiral plates, and the power applied to the same."

Claim.—"What I claim as my invention, is the propeller constructed of two spiral, curvilinear, tapering plates, formed and secured to the shaft, as represented and described, and connected together at their outer extremities; and this I claim, irrespective of the number of sets of these propellers that may be placed on one shaft, or of the number of shafts that may be used in propelling one vessel."

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74. For a *Method of Ringing Fog Bells, and an Adjustable Clapper for the Same;* Daniel Jones, Jr., St. Johns, New Brunswick, November 27; anté dated August 22.

The patentee says,—"My invention consists in ringing a bell by machinery, in such man-

ner that the sound may be varied at will, so as to make different signals to approaching vessels. I have likewise so constructed the clapper, that the blows struck by it in different positions of the bell shall always be equal in intensity."

Claim.—"What I claim as my invention, is indicating to vessels the position of channels, shoals, or reefs, the depth of water, or state of the tide or currents, at the entrance of harbors or elsewhere, by the varying ringing or tolling of a bell operated by adjustable machinery, substantially as set forth.

"I also claim the combination of a shifting weight with the clapper, whereby its blows upon the bell, in the several positions in which it strikes the same, are equalized."

RE-ISSUE FOR NOVEMBER, 1849.

1. For an *Improvement in Looms for Weaving Brussels Carpeting, &c.;* Erastus B. Bigelow, Clintonville, Worcester county, Massachusetts; patented March 13, 1849; re-issued November 20, 1849.

The patentee says,—"My improvements consist in giving to the lathe of the loom a counter motion, whereby the reed may be made to approach nearer the face of the cloth at some of its beats than at others, for the purpose of properly laying the filling to form the pile of the cloth, and carrying the trough or grooved bar, employed to carry the wires between the warps, or the equivalent thereof, forward to clear the shed before it is withdrawn therefrom."

Claim.—"What I claim as new, is, 1st, giving to the lathe of the power loom a counter motion, to vary the extent of its approach towards the face of the cloth at any required beat, to properly lay the filling to form the pile of the cloth, or clear the shed as above specified.

"2d, Moving the trough or grooved bar, which is employed to carry the pile wires under the warps, or the equivalent thereof, forward towards the face of the cloth, to clear the shed as above described, or in any other way which shall accomplish the same end by substantially the same means."

ADDITIONAL IMPROVEMENTS FOR NOVEMBER, 1849.

1. For an *Improvement in Machines for Threshing and Cleaning Grain;* B. G. H. Hathaway, Rockstream, Yates county, New York; patented July 5, 1848, additional improvement annexed November 6, 1849.

Claim.—"What I claim, is, 1st, the modification of the shoe by the employment of the cover, as specified, to the upper spout, and forming an offset and opening together with the spout, as described.

"I also claim the concave, made adjustable and reversable, in the manner and for the purposes set forth."

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2. For an *Improvement in Seed Planters;* James D. Willoughby, Chambersburgh, Franklin county, Pennsylvania; patented June 5, 1849, additional improvement annexed November 20, 1849.

The patentee says,—"The nature of my improvements consists, 1st, in the method of connecting the beam of the share with the framework of the machine; 2d, in the method of depressing the shares, and holding them below the surface of the ground; 3d, in the device for stopping the discharge of seed; 4th, in the device for holding the shares in their proper position for ploughing seed furrows, which is so arranged that it will afford sufficient resistance that it will divide the earth through which the share passes, but shall give way and allow the share to move backwards, whenever the latter strikes a stone, stump, or other obstruction, with a force which would otherwise break the machine."

Claim.—"What I claim as new, is hinging the teeth to the frame or beam, and bracing them by flexible struts, which possess a sufficient rigidity to resist all ordinary strains to which the teeth are subjected without flexing, but which suddenly yield and allow the teeth to turn back when they meet with an obstruction which would otherwise break or stop the machine, as described and represented."

DESIGNS FOR NOVEMBER, 1849.

1. For a *Design for Stoves;* Morrison & Tibbits, assignees of Abram Haney, Troy, New York, November 6.

2. For a *Design for Stoves;* E. Johnson and D. B. Cox, assignees of Samuel Clark, Troy, New York, November 13.

3. For a *Design for Stoves;* Johnson & Cox, assignees of Samuel Clark, Troy, New York, November 13.

4. For a *Design for Stoves;* Johnson & Cox, assignees of Samuel Clark, Troy, New York, November 13.

The claims to the above are to the designs of ornaments, mouldings, scrolls, &c., as described in the several specifications.

List of American Patents which issued in December, 1849, with Exemplifications by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Mills for Grinding;* Sidney A. Bantz and William Andrew, Frederick, Frederick county, Maryland, December 4.

The patentees say,—"Our invention consists, 1st, in giving a vibratory motion to the concave, so that it shall diverge from, and close towards, the cylinder, whereby a drawing motion is communicated to the teeth, which thus cut as well as crush the bark. 2d, In the peculiar form given to the teeth of the concave, which increases their strength, and enables them to act more effectually on the bark."

Claim.—"What we claim as our invention, is the vibratory motion given to the concave, substantially in the manner as herein set forth."

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2. For a *Method of Counterbalancing Window Sash;* Wesley Chase, assignee of William T. Barnes, Buffalo, New York, December 4.

The patentee says,—"My invention consists in attaching a rack to each sash, the teeth of which gear into those on the opposite sides of the same pinion, the axle of the pinion being attached to a hinged spring lever, so that it can be thrown out of gear with the rack of one sash, and at the same time locked in such a manner that it is prevented from being turned by the weight of the other sash."

Claim.—"What I claim as my invention, is the arrangement herein described of the hinged lever, pinion, and racks, with respect to a couple of window sashes, whereby the sashes can be connected and disconnected, adjusted, and counterbalanced, as set forth."

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3. For a *Double Revolving Scraper;* Ashley Crafts and Ebenezer Weeks, Auburn, Geauga county, Ohio, December 4.

Claim.—"What we claim as our invention, is the double cavity or cima-reversa scoop or scraper, whether of the precise shape described, or of any other substantially the same, revolving on pivots, so as to discharge and reload itself without being stopped and righted, irrespective of the particular form of frame in which it is placed, in combination with devices, substantially as described, for fastening and setting free the same."

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4. For an *Improvement in Stone-Dressing Machines;* William Eayrs, Concord, Merrimack county, New Hampshire, December 4.

The patentee says,—"The whole of my invention is to be found not only in the manner in which, or by which, I sustain and operate each of the chisels, but also in the means adopted to produce the blow or percussion thereon, necessary to cause it to remove the surplus material from the block of stone."

Claim.—"I claim the rotary hammer, as constructed and combined with each chisel-stock, and made to impinge against it, and permit it to immediately afterwards move forwards, preparatory to another blow, as specified."

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5. For an *Improvement in Grain Separators;* S. W. Fisher, Scio, Washtenaw county, Michigan, December 4.

Claim.—"What I claim, is the combination of the raking apparatus with the notched surface under which the irons on the ends of the rakes pass, by which means the rakes are

caused to shake, which motion of the rakes shakes the straw, and thereby separates the grain from it."

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6. For an *Improved Frog for Railroads;* Henry A. Landry, Camden, Camden county, New Jersey, assignee of John W. Hoffman, Philadelphia, Pennsylvania, December 4.

Claim.—"What I claim as my invention, is a railroad frog constructed with hinged leaves, acted upon either by weights or springs, essentially in the manner and for the purposes described."

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7. For *Improvements in File-Cutting Machines;* Camillus Kidder, administrator of George Crosby, Baltimore, Maryland, December 4.

Claim.—"What I claim, is, 1st, the peculiar combination of the spring with the hammer, in the manner and for the purpose set forth.

"2d, The application of a check-bar for the purpose described."

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8. For an *Improvement in Cooking Ranges;* Nicholas Mason, Roxbury, Norfolk county, Massachusetts, December 4.

The patentee says,—"The nature of this invention consists in combining and arranging a series of boilers, ovens, flues, dampers, and their necessary attachments, in such relation to each other and the fire chamber, as to form a compact and convenient cooking range, capable of supplying all the wants pertaining to the culinary department, as well as to form a heater to warm the rooms of the house in which it is situated, with a slight amount of fuel, considering the benefits accomplished."

Claim.—"1st, I claim the arrangement of the flues on the sides, front, back, and bottom of the boiler, formed by the sides, front, back, and bottom of the boiler, and the upright plates provided with valves at the top and brickwork of the range in the manner and for the purposes set forth.

"2d, I also claim the arrangement of the flues on the sides and back of the fire chamber, and the flues under, and at the back part and side of, the oven and horizontal trunk, with valves, and communicating with the apartments to be heated, for heating the air admitted from the cellar or other place by the valves, to the proper degree to be conveyed to the apartments, as described.

"3d, I likewise claim the arrangement of the plates projecting from the plate *l*, and openings in said plate, for dividing the heat, and causing one portion to be carried around the front part of the wash-boiler, and the other portion around the back part of the same, as described."

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9. For an *Improvement in Making Artificial Teeth;* George E. Murray, Philadelphia, Pennsylvania, December 4.

Claim.—"What I claim as new, is an artificial tooth having a plate combined therewith, substantially in the manner and for the purposes set forth."

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10. For an *Improved Concealed Trigger for Fire Arms;* Jacob Pecare and Josiah M. Smith, City of New York, December 4.

The patentees say,—"The nature of our invention consists in so constructing a revolving or repeating pistol that an accurate aim may be taken: that an assailed party cannot, by grasping the barrels, prevent the assailant from repeating his fire; that the concealment of the trigger, hitherto unattained in revolvers, but particularly desirable in this kind of pistol, is effected; and that the barrels are made to revolve by simple mechanical means; thus combining, in an unusual degree, efficiency of action, security from accidental discharge, portability, and cheapness of construction."

Claim.—"What we claim as of our invention, is the construction of a concealed trigger, capable of being disclosed and made ready to operate by simple pressure imparted by the hand to its rear end, as described."

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11. For an *Improvement in Mills for Grinding;* Samuel W. Powell, Tuscarora Valley, Juniata county, Pennsylvania, December 4.

The patentee says,—"My invention consists in forming helical or screw-shaped ribs on the barrels of two rolls, the surfaces of which are driven with different velocities, so that the

corn is not only crushed between them, but is cut by the sharp edges of the ribs of one roll passing obliquely over those of the other."

Claim.—"What I claim as my invention, is a grinding mill consisting of two rolls, on whose surfaces grooved and fluted helical ribs are formed, and which move with different velocities, the several parts of the machine being arranged and operated substantially as set forth."

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12. For an *Improvement in Pumps for Raising Water;* Alexander Stiven, City of New York, December 4.

Claim.—"What I claim, is the annular ring, with radial arm and slot, in the cylinder, immediately between the exit and entrance, and giving motion to the annular ring or piston by an eccentric or cam, and the whole operating conjointly together as set forth."

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13. For *Improvements in Machinery for Spinning Hemp;* Garret Van Riper, Jersey City, Hudson county, New Jersey, December 4.

The patentee says,—"The nature of my invention, as regards the flyer, consists in composing the ends thereof of circular heads instead of transverse arms, as heretofore used; and, as regards the speed of the bobbin, in regulating the comparative speed of the bobbin by a simple contrivance, susceptible of the nicest gradations, and not subject to any of the inconveniences of the old method of loading."

Claim.—"What I claim as my invention, is the use of a circular-headed flyer, having a circular head at each end, constructed and operating substantially as shown.

"I also claim, in combination with a flanch or shoulder near the foot of the spindle, and permanently attached thereto, the use of a movable friction plate of metal, when the same is pressed to the flanch or shoulder, or upon an interposed washer, by an adjustable spring or lever pressing on both sides of the spindle, and thereby producing a drag or retardation; while, by its longitudinal action, it retains the spindle steadily in its step, at the same time increasing the friction and retardation; whereby I am enabled to impart any required degree of tightness to the yarn as spun, and give it a greater uniformity of texture than can be done by any other known method, as set forth."

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14. For *Improvements in Condensers and Stuffing Boxes of Vapor Engines;* Prosper Verdat du Trembley, Paris, France, December 4; anté dated March 10, 1847.

Claim.—"I claim the ether generator or vaporizer, and condenser, constructed substantially as described, whereby I obtain more perfect joints.

"I also claim packing the stuffing boxes, by means of leather, or other analogous substance, surrounding the body to be packed, when the said leather, or other substance, is surrounded by a chamber containing a fluid under pressure, substantially as described."

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15. For an *Improvement in Cast Iron Car Wheels;* Hiram H. Wiser, Rochester, New York, December 4.

The patentee says,—"The nature of my invention consists in constructing a railroad car wheel, by combining sunk and raised panels, which I apply to the plates of which the wheel is formed."

Claim.—"What I claim as my invention, is the particular manner of forming my wheel, it being formed of an inside and outside plate; each plate being formed of sunk and raised panels alternately, the space between the raised panels extending from the hub to the tread; the parts of the plates which form the sunk panels join between the hub and the tread, for the purposes substantially as described."

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16. For an *Improvement in Detachable Buckle Tongues;* Alvah Worster, Hannibal, Oswego county, New York, December 4.

Claim.—"What I claim as new, is the detachable buckle tongue, constructed and arranged in the manner and for the purpose represented."

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17. For an *Improvement in Apparatus for Dyeing;* Edward Brierley, Lowell, Massachusetts, December 11.

The patentee says,—"My process is peculiarly applicable to producing stripes or figures of various colors in cloth; it differs essentially from the usual practice of producing such figures

by imprinting them on the surface of the cloth, as, by my method, they are dyed into and through the cloth during the process of dyeing it."

Claim.—"What I claim as my invention, is the above specified mode or process of producing either stripes or fancy patterns, on or in cloth or fabrics of various kinds, the same consisting in the employment of one or more dye-vats, and a dyeing-frame, so constructed as to prevent the dyeing liquid from penetrating those portions of the cloth which we may not desire to color, and at the same time allow the coloring liquid to freely come in contact with the remainder, or those which it may be desirable to color; all substantially as specified.

"And, as auxiliary thereto, I claim the employment of the vertical frames, in connexion with the main dye-frame, in manner and for the purpose of protecting from contact with dyeing liquid those parts of the cloth which may be strained directly over against, or on, the ends of the horizontal strips of the main dye-frame, as set forth."

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18. For an *Improvement in Brick Presses;* John T. Brown and Moses Fuller, Midville, Burke county, Georgia, December 11.

Claim.—"What we claim as our invention, is the combination of the horizontal mould-wheel with the mechanical discharger and endless conveyor, in the manner and for the purpose set forth."

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19. For an *Improvement in Apparatus for Bending Hames;* Abel Gardner, Buffalo, New York, December 11.

Claim.—"What I claim as my invention, is the process of bending hames, by means of the combination of the hook-piece and the iron strap made fast at the ends, in the manner and for the purpose set forth."

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20. For an *Improvement in Machinery for Turning Clothes Pins;* Asa Greenwood, Marlboro', Cheshire county, New Hampshire, December 11.

Claim.—"What I claim as my invention, is the rotary mandril, the cutter for reducing the stick to a cylindrical shape, the cutter for forming the body of the pin, the cutter or cutters for forming the head, the centre rod, its fork and pattern lever; the whole being applied to carriages, and made to operate together substantially in manner and for the purpose as specified."

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21. For a *Double Bolt Trick Lock;* Lewis M. Hartley, Kensington, Philadelphia county, Pennsylvania, December 11.

The patentee says,—"The nature of this invention consists in arranging in the case of the lock two pair of bolts, one above and the other below the keyhole, the plates of those nearest the keyhole being notched on their edges, to receive the fingers of the key and pins projecting from the tumblers, and the plates of their mates being provided with pins, extending downward and entering slots formed in traversing plates arranged below the tumblers and guard, and operated on by the lower finger of the key, in such a manner as to allow of the bolts and plates nearest the keyhole to be moved by inserting the key partly in the lock, and turning the same half-way round above the guard, whilst the others are prevented from moving at all, except by forcing the key to the full depth in the lock, after making the half revolution named, and turning it back to its first position, causing the bolts first moved to be drawn into the lock, and their mates to be thrown out, when the key can be drawn slightly out, so as to bring its fingers above the guard, and again turned so as to throw the bolts nearest the keyhole out, without affecting the others, thus making it impossible to move the bolts farthest from the keyhole, except through the agency of the other two; and also in providing the lock with other safety guards hereinafter mentioned."

Claim.—"What I claim as my invention, is the combination and arrangement of the twin bolts, (any number being arranged in the same case,) tumblers having pins at their ends which enter corresponding notches in the bolts, traversing slotted plates, pins on the bolts, entering the slots of said plates, substantially as herein set forth; the bolts nearest the keyhole being required to be thrown out and in before the other bolts can be thrown out, and *vice versâ*, as described."

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22. For an *Improvement in Packing Pump Pistons;* Edwin A. Jeffery, Corning, Steuben county, New York, December 11.

The patentee says,—"My invention consists in so constructing the pistons of pumps that

a quantity of water shall always intervene between their interior surface and the external air, being, in fact, the substitution of water to pack the piston, for metal gasket, leather, and other substances heretofore employed for that purpose."

Claim.—"What I claim as my invention, is the pump piston constructed essentially of two disks and a valve, substantially as herein set forth, whereby it is rendered capable of keeping itself packed with water."

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23. For an *Improvement in the Mode of Changing the Gearing of Drawing Heads while in motion;* Alfred Jenks, Bridesburg, Philadelphia county, Pennsylvania, December 11.

The patentee says,—"In drawing heads, it is essential that the speed of the drawing rolls should vary with the quantity of cotton fed to them, in order that the sliver produced may be always of uniform size; and my invention consists in giving a triangular cross section to the key-seats of a cone of differential cog wheels, through which the constant speed of the prime mover is transmitted to the rolls, and in attaching a sliding key of a corresponding cross section to a spring bar, which is received in a groove extending lengthwise in the surface of the spindle on which the cog wheels are mounted; the spring bar extends beyond the end of the spindle, and is moved by hand from the key-seat of one wheel to that of another, when it is necessary to change the speed of the drawing rolls."

Claim.—"What I claim as my invention, is a sliding spring key, arranged and operated substantially as herein set forth, for connecting any one of a series of wheels with a common spindle, and for disconnecting it therefrom, at will."

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24. For an *Improvement in Looms for Weaving Figured Fabrics;* Moses Marshall, Lowell, Massachusetts, December 11.

The patentee says,—"The elementary features of my improvements consist in a series of stationary rests which support the jacks of the harness, when sheds operated by them are not in use; the chain shafts and lifting and depressing bars, for operating the jacks and harness; and the evener, as I term it, which is composed of two rollers, set in a frame having a reciprocating rectilinear motion, which rollers press against the beveled ends of the harness, and assist in shifting the sheds of yarn, and, what is more essential, operate always to keep the levers even; for the proper operation of the cams on the pattern chain."

Claim.—"What I claim as my invention, is the improvement herein above described in the machinery for operating the harness, so that any proper number of heddles may be used or changed, as desired, without taking the loom to pieces; said improvement consisting, first, in providing the movable spring rests for supporting the jacks of the harness when they are not in use, and which are sprung back by the bevel face on the shoulders of the jacks, when they are kept in play by the cams on the pattern chain, the whole arrangement being substantially as herein above set forth; and second, in the 'evener,' constructed and operated as herein described, for assisting in moving the upper heddle levers and keeping them even, so that the cams or rollers on the pattern chain will operate accurately on the jacks, as specified;—meaning to claim the exclusive use of said spring rests and evener in a loom, the invention of which is entirely original with me.

"I also claim the combination of rotating lifting and depressing bars, arranged in endless chains, so as to revolve as described, with the forked jacks having internal shoulders, as described."

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25. For an *Improvement in Bedstead Fastenings;* John Moulton, Ossipee, Carrol county, New Hampshire, December 11.

Claim.—"What I claim as my improvement in the fastening, is the use of several projections, as set forth, combined with the recesses cut into the sides of the mortise, substantially in the manner and for the purposes set forth."

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26. For *Improvements in Machinery for Preparing Hubs for Boxes;* Isaac Munden, Allegheny City, Pennsylvania, December 11.

The patentee says,—"The nature of my invention consists of a combination of adjusting clamps or jaws with a mandril, for the purpose of centreing the mandril perfectly, and holding a carriage or wagon hub firmly while being bored; the application to the mandril of a screw with a thread of the square and V-form, working in a segmental hinge nut, for the purpose of preventing the mandril from going downwards too fast while boring, and yet at the same time allowing the operator to raise and lower it at pleasure; a peculiar mode of

forming the cutting tool for boring, and fastening it to the mandril to keep it tight; and also an arrangement for screwing and unscrewing the cutting tool without using a wrench; which several parts, together with other subordinate and operating parts connected therewith, constitute a boxing machine for boring out the inside of wagon and carriage hubs with great despatch, precision, and regularity."

Claim.—"What I claim is, 1st, the hinged jaws constructed and arranged in the manner described, and operated as set forth, for centreing the mandril to bore wagon or carriage hubs.

"2d, I claim the hinged segmental nut, constructed as described, in combination with the mandril which has a square and inclined thread cut upon it, to coincide with a thread of the same form cut on the inside of the said nut, to prevent the mandril from feeding down too fast in the act of boring, and also to allow the mandril to be moved up or down at pleasure, in the manner substantially as herein described.

"3d, I claim the mode of fastening the cutter to the mandril, by passing it through the slot or eye of the nut or cutter-box, formed with an interior thread to fit on to the screw-pin of the mandril, whereby, by screwing on the nut, the end of the mandril is made to retain the cutter firmly in the proper position for boring. In connexion with this arrangement for setting and securing the cutting tool, I claim the cutter-box formed with the projection, whereby, by raising it (the box) until it comes in contact with the shoulders formed by the braces, the cutter can be screwed and unscrewed without a wrench, as herein fully set forth."

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27. For an *Improvement in Machinery for Making Cord;* William E. Nichols, East Haddam, Middlesex county, Connecticut, December 11.

The patentee says,—"My invention relates to the manner in which the bobbin frames are turned on their own axes, to twist the yarns from the bobbins which they respectively carry into strands, while at the same time they are carried around a common centre to twist the strands into a cord; the manner in which the relative amount of twist given to the cord, and the individual strands of which it is composed, can be varied at will; the manner of laying the yarns of the strand; and the construction of the compressing tube for smoothing and condensing the cord after it is laid."

Claim.—"What I claim as my invention, is, 1st, revolving the bobbin frames on their own axes to twist the strands, at the same time that they are carried round a common centre to twist the cord, by rolling them on the surface of a stationary annular inclined track, towards the inner or outer periphery of which they can be adjusted to run; so as to vary the relative twist of the strands and cord, substantially as herein set forth.

"2d, I claim the construction and arrangement of the central stem or spindle of the bobbin frame, operating substantially as herein set forth, whereby the yarns are collectively subjected to progressively increasing tension and twist from the commencement to the end of the process of laying them into the strand, whereby the latter is rendered smooth and regular in its figure, and of uniform strength and density, and subjected to uniform tension while being laid into the cord."

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28. For an *Improvement in Making Tin Boilers for Cooking Stoves, with Cast Iron Bottoms;* Gibson North, Philadelphia, Pennsylvania, December 11.

The patentee says,—"The nature of my invention consists in the union of a tin top to a cast iron bottom, so coated as to prevent rusting, and to be both more durable and more economical than bottoms of tin or copper."

Claim.—"What I claim, is my improvement in the manufacture of boilers for cooking stoves, as above set forth: that is, making the bottoms of cast iron and the bodies of tin, the two being soldered together substantially as described."

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29. For an *Improvement in Bedstead Fastenings;* J. Parsons Owen, Norwalk, Huron county, Ohio, December 11.

Claim.—"What I claim as new, is a bedstead fastening consisting of a box formed of two parts, having screw-threads therein, and divided through the centre longitudinally in the plane of the axis of said screws, as described; said parts being so formed by locks as, when inserted into a bedpost, to have both parts firmly held in place against the force of the screw."

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30. For an *Improvement in Faucet-Breech Guns;* Alonzo D. Perry, City of New York, December 11.

The patentee says,—"My invention relates to the class of fire arms in which the charge is

introduced at the breech, into a vibrating cylinder which receives the charge in one position, and then, by turning a part of a revolution, brings said charge on a line with the bore of the barrel, and into position to be discharged.

"The first part of my invention consists in having a vibrating breech, which is enclosed in a chamber, on journals, that its periphery may turn freely in the chamber. And this part of my invention also consists in combining with the above mode of hanging the vibrating breech in a chamber, the making of a groove or grooves in the inner periphery of the chamber around the bore of the barrel, and extending out at the side or sides, for the free escape of the gases and smoke from the discharge, to prevent the accumulation of the deposits of smoke on the periphery of the breech and chamber, thus preventing all clogging or danger of fire being driven back into the charger.

"The second part of my invention consists in combining with a vibrating breech a charge-holder, for containing a series of cartridges or charges, and located in the breech of the stock, so that by vibrating the breech, its mouth can be presented to the charge-holder to receive the cartridge, and then turned back to bring it in a line with the bore of the barrel for the discharge, the turning of the barrel cutting off all communication with the charge holder; and this part of my invention also consists in combining with the charge-holder and vibrating breech a transferring lever, which takes the cartridge from the charge-holder and transfers it into the breech, the position of the charge-holder, relatively to the vibrating breech, is such that, in the act of discharging the gun, the recoil tends to close the opening into the charge-holder, and thereby prevent any fire being thrown back into the charge-holder or magazine, and secures them from danger of explosion."

Claim.—"What I claim as my invention, is, in combination with a vibrating breech, turning within a chamber, the making of a groove or grooves in the inner periphery of the chamber, and extending out at the side or sides thereof, for the purpose and in the manner substantially as herein described. I also claim the revolving charge-holder located in the breech of the stock, substantially in the manner and for the purpose specified. And finally, I claim the combination of the levers, by means of which one charge only is permitted to fall forward at a time when the muzzle of the gun is depressed, and by which it is forced home into the vibrating breech, as described."

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31. For an *Improved Apparatus for Drawing Water from Wells;* Harvey W. Sabin, Reed's Corners, Ontario county, New York, December 11.

Claim.—"What I claim as my invention, is the mounting of the respective parts of the drawing apparatus upon the rotating disk, when the said disk is placed upon, and supported by, the circular platform, which has the grooves formed in its face, and the notched ears rising from its periphery, that are combined and operate with the drawing apparatus, substantially in the manner and for the purpose as described."

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32. For *Improvements in Self-Acting Car Couplings;* Albert G. Safford, Boston, Massachusetts, December 11.

Claim.—"What I claim as my invention, is the revolving series of arms, and the link constructed with an opening or cross bar at one end, or each of its ends, in combination with the box and pawl, all substantially as specified."

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33. For an *Improvement in Machinery for Jointing Staves;* David Vaughan, Remsen, Oneida county, New York, December 11.

The patentee says,—"The nature of my invention consists in providing a shaving cutter on a slide, which has a depression at the middle where the shaving tool is secured, to shave the one-half of the taper on the edge of the stave, from the bilge to the end, by the shaving tool cutting in one direction, and to shave the other taper from the bilge to the end of the stave in the opposite direction.

"My invention furthermore consists in providing side guide rails, with a depression in the middle of them, to correspond with the depression in the middle of the jointer slide, and this depression and the side rails to be employed in combination with the slide and clamps, or a clamp to guide the stave to the action of the shaving knife, to shave the edge of the staves at an angle, to produce any edge taper on the stave for casks or barrels of different diameters.

"My invention further consists in providing a clamp with a movable jaw, to secure the stave between it and the stationary jaw, the said jaw being opened and closed by pushing it backwards and forwards against the side pressure of stationary pins, to exert a great power to retain crooked staves, and an easy plan to take out and put in the stave."

Claim.—"I claim the plane-stock of the jointer, formed with a depression in the middle, for the purpose of guiding the shaving plane, to shave the exact taper on the stave, from the bilge on the middle to the end of the stave, in the manner herein described, in combination with the mode of producing a traverse taper or feather of any angle on the edge of the stave, according to the diameter of the cask or barrel, by the stave being held to the action of the shaving knife, by the combination of the plane-stock and the clamp with the guide rail, in the manner herein described."

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34. For an *Improved Machine for Grinding or Polishing Tools;* Joseph Vaughan, Jr., Union, Lincoln county, Maine, December 11.

The patentee says,—"The nature of my invention consists in a machine so constructed and arranged as to hold an axe or other implement on a polishing wheel, and give it the motion required to bring every part of the surface required to be polished in contact with the polisher, in such a manner as to give every part a sufficient and uniform polish, and by means of which one man or boy may tend the polishing of a number of axes or other implements at the same time, making a great saving of labor."

Claim.—"What I claim as my invention, is the following, to wit:—1st, That part of the above described machinery by which an axe or other implement to be polished receives a reciprocating motion, and by which that motion is regulated, in combination with that part of the machinery by which it is made to cant or rotate at the same time, sufficiently to present all part of the surface to be polished to the polishing wheel.

"2d, The machinery described for holding and giving motion to the axe or other implement while being polished, in combination with the polishing wheel, moved and kept in motion in the manner described."

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35. For *Improvements in Operating the Hammers of Spike Machines;* Harry A. Wills, Keeseville, Essex county, New York, December 11.

The patentee says,—"My invention consists in drawing out the point of the spike by a set of hammers which act on the four sides of the rod, they being so arranged that they are drawn forwards along the point between the blows, and at the same time made to strike closer together. The machine is so constructed that the fibre of the steel, of which the knives, dies, header, &c., are made, is opposed endwise to the pressure."

Claim.—"What I claim as my invention, is, 1st, the combination of advancing and receding hammers with their respective adjustable wipers and hinged drags, arranged and operating substantially as herein set forth.

"2d, I claim the adjustable wipers, which can be set to cause the hammers to form spike points more or less sharp.

"3d, I claim drawing the pointing hammers of a spike or nail machine along the rod, substantially in the manner herein set forth, during the operation of forming the point."

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36. For an *Improvement in Bending Wood;* Thomas Blanchard, Boston, Massachusetts, December 18.

Claim.—"What I claim, is my method of bending fibrous materials by means of the upsetting movements, or the upsetting and relaxing movements combined, as exemplified in the screw H, whether such movement or movements be produced by means of the screw, wedge, comb, lever, rack and pinions, or any other equivalent means."

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37. For an *Improvement in Bran Dusters;* Robert M. Dempsey, Indianapolis, Marion county, Indiana, December 18.

Claim.—"What I claim as my invention, is constructing the rotary scourer and separator with concentric roughened and reticulated prismatic rings, and hanging roughened or toothed prismatic rings, the latter being placed in the spaces between the former, so as to leave concentric spaces between their inclined surfaces, for the passage of the bran and flour over and around the ridges and sides of the aforesaid several prismatic rings, in the manner and for the purpose set forth, by which the flour adhering to the bran, after leaving the ordinary bolts, is completely separated therefrom and saved, to be mixed with the superfine flour, or for any other purpose which the miller may desire; the flour passing through the wire bolting screens, and out of the curb or case, through the spout S, whilst the bran is forced to the upper part of the curb, and out of the spout R, by the centrifugal action of the separator, aided by the blast of wind created by the rapid rotary motion of the said scourer and separator, as set forth."

38. For an *Improvement in the Manufacture of Buttons;* W. R. Hitchcock & Co., assignees Peter Kirkham, Waterbury, New Haven county, Connecticut, December 18.

The patentee says,—"The nature of my invention consists in substituting wooden moulds for the common stuffed metallic shell, and combining the said mould or moulds with the ring or collet, in such a manner as to secure the shank and covering of the button inside between the wooden mould and the collet or ring."

Claim.—"I claim the new and useful improvement in the manufacture of buttons of substituting a wooden mould for the common metallic shell that is stuffed with paper, and using the said wooden mould either for the top or bottom of the button, and covering the button entirely, or only part of it, with some textile fabric or substance, and securing the shank and the covering inside between the wooden mould and ring or collet of the button, in the manner herein described."

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39. For an *Improvement in Clover Harvesters;* Samuel Krauser, Reading, Berks county, Pennsylvania, December 18.

The patentee says,—"My invention consists in giving to the teeth an improved form, and making the stock to which they are attached adjustable, so as to carry them at different heights from the ground, to adapt them to stripping the seed off clover plants of different heights, combining with the teeth a transverse knife, attached to, or passing through, their rear ends, and so arranging the teeth that, at whatever height they may be placed above the ground, the angle they make therewith will be very nearly the same."

Claim.—"What I claim as my invention, is maintaining the series of teeth at nearly the same angle with the ground, at all heights to which they may be adjusted therefrom, in the manner herein set forth.

"I also claim forming the fingers with a depression on their upper side above the knife, substantially in the manner and for the purpose set forth."

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40. For an *Improved Alarm for Indicating Want of Water in Boilers;* Azel S. Lyman, Upper Alton, Madison county, Illinois, December 18.

The patentee says,—"The nature of my invention consists in the combination of the air-gauge or mercurial tube with a metallic vessel, filled with water, secured to the flue of the boiler, or other part which will receive extra heat whenever the water falls too low; said vessel also being connected by a metallic tube to an elastic valve, which, when the heat is greater in the vessel secured to the flue, (which will only occur when the water is low,) will raise the mercury in the water-gauge, and also the lever of the elastic valve; this lever at the same time raises the steam valve of the gauge, and operates a steam whistle to give warning."

Claim.—"I claim the introduction of the tube or box on the flue, or other surface exposed to extra heat when water is too low, filled with water or other suitable liquid, for the purposes set forth."

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41. For a *Combined Lap and Butt-Welded Tube;* James McCarty, Reading, Berks county, Pennsylvania, December 18.

Claim.—"What I claim, is a pipe composed of a combination of the butt-weld with lap-welded ends, as set forth."

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42. For *Improvements in Folding Gates;* Isaac Meritt, North West Bridgewater, Plymouth county, Massachusetts, December 18.

The patentee says,—"The nature of my invention consists in the novel application of the well-known principle of construction called the 'lazy tongs,' in combination with a railway, wheels, recessed receiving posts, and vertical parallel guide posts, by which I produce a curious and beautiful expanding and contracting gate of small pieces of timber, or bars of iron, either single or double, which may be moved partially or wholly over a horizontal railway to any degree required, by the application of very little power."

Claim.—"What I claim as my invention, is a single or double gate, constructed substantially as herein above described, so as to fold up horizontally in opening the same, by degrees, according to the width of the opening required, without the necessity of moving the whole structure, as when it swings on hinges horizontally in the arc of a circle, or vertically on a horizontal bolt or pin, when folding in the manner of a parallel ruler; my said improved gate moving horizontally over rails on wheels, with great ease, whilst being contracted or expanded in opening or closing the gate, as set forth."

43. For an *Improvement in the Manufacture of Flax and Hemp;* Robert Patterson, New Hartford, Oneida county, New York, December 18.

The patentee says,—"The nature of my invention consists in treating what is called the lap with an alkaline solution, then washing it in water, and afterwards drawing it in a wet state in the common cotton drawing frame, upon the same principle as drawing cotton, in order to draw a finer thread from the lap than can be done by the common dry process of drawing, and to prevent the making of so much tow as is now made by the common process."

Claim.—"What I claim as new, is the following process for preparing hemp and flax for spinning, viz., the treating of the lap, after it comes from the spreading frame, with an alkaline solution to soften the gluten of the flax, and washing it afterwards, as has been described, as a preparatory process for drawing it in the common drawing frame, and drawing the flax lap in the common drawing frame, while the said flax lap is in a wet state, to draw out and separate the finer from the coarser fibres, and reducing the flax to its greatest possible fineness, making less tow, and running the machinery at a greater speed than by the dry process, and dispensing with the hetchell gill frame, substantially as set forth."

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44. For an *Improvement in Signal Lanterns;* Hugh Sangster, Buffalo, New York, December 18.

Claim.—"What I claim as my invention, is subdiving the front of the lantern into three divisions or sectors, and arranging and operating the colored glasses enclosed therein, in the manner described."

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45. For an *Improved Method of Revolving the Hammer of Repeating Fire Arms;* Christian Sharps, City of Washington, D. C., December 18.

The patentee says,—"My invention consists in attaching to a revolving hammer a double-faced ratchet, which is acted upon by two levers, which together turn the hammer the angular distance required to discharge the barrels consecutively."

Claim.—"What I claim as my invention, is the combination of the cocking and spring levers with the double ratchet wheel on the revolving hammer, substantially in the manner set forth."

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46. For an *Improvement in Churn Dashers;* Henry Stanton, Richfield, Otsego county, New York, December 18.

The patentee says,—"The nature of my invention consists in a peculiar construction of a spiral float for churning and gathering the butter, combined with an air tube or arm, placed in such position as to form a vacuum when turned with a slow motion, said arm being made in the form of a wedge, and provided with a valve to prevent the butter getting in the tube whilst gathering the butter; likewise to prevent the cream getting into the said hollow arm whilst the churn is not in action. Also in constructing the top of the hollow shaft of the spiral float funnel-shaped, for pouring an alkali, for disseminating it more evenly through the cream. Likewise in combining with the churn a heater and cooler, which is made movable, so as to be taken out and put in at pleasure, for keeping the cream at the required temperature, using heated or congealed water in the heater and cooler, for raising and lowering the temperature of the cream to be churned."

Claim.—"What I claim as my invention, is the combination of the perforated spiral float with the prismatic radial arm and vertical shaft, arranged and operating in the manner and for the purpose herein set forth."

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47. For an *Improved Valve-Motion, Cut-Off, and Steam-Stops for Rotary Engines;* Henry G. Thompson, City of New York, December 18.

Claim.—"What I claim as my invention, is, 1st, the method of operating the steam-stops or abutments, by a crank-motion derived from the rotation of the piston-wheel, substantially as described, when this is combined with the rotating piston-wheel, the form of the periphery of which is such as would be generated by its rotation and the motions of the steam-stops, substantially as described, that the steam-stops may always, in their motions, be in contact with the periphery of the piston-wheel, and not operated by such periphery, as described.

"2d, I claim making the ends of the steam-stops with projections or toes, that embrace the sides of the piston-wheel, and extend within the periphery thereof, substantially as described, when this is combined with the grooves or recesses in the packing ring, or any equivalent substitute therefor, substantially as described, whereby the steam is prevented from passing

from one side to the other of the pistons, through the grooves or recesses in which the ends of the stops slide, as described. And,

"3d, I also claim, in combination with the herein described method of operating the steam-stops, the employment of cut-off valves, operated by eccentrics, or their equivalents, on the crank-arbors that operate the steam-stops, substantially as described."

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48. For an *Improvement in Bottle Fasteners;* Isaac Winslow, Philadelphia, Pennsylvania, December 18.

Claim.—What I claim as my invention, is the combination of the metallic caps with the tube, constructed and used in the manner and for the purpose set forth."

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49. For an *Improved Concealed Hammer and Turning Nipple Lock;* Andrew Wurfflein, Philadelphia, Pennsylvania, December 18.

The patentee says,—"The nature of my invention consists in so constructing the lock that the percussion cap, or other primer used to explode the charge, is entirely protected from the weather, concealed from view, and, when exploded, does not cause a volume of smoke to rise above the lock, nor any particles of the primer to escape from the chamber at the moment of discharging the piece;—accidental or premature discharges being prevented by securing the trigger by a spring catch; the priming being effected by placing the cap upon the nipple with the thumb and finger when exposed; said nipple being screwed into a swing lever affixed to the lock-plate by a fulcrum pin, and made to turn or swing horizontally in the arc of a circle, to expose the nipple to receive the primer from the outside, and conveying it inside of the cap or priming chamber; the hammer being cocked simultaneously with the operation of turning the nipple; the trigger being secured from turning until required to act on the seer, by the said spring catch, which is disengaged from the trigger in the act of grasping the piece to discharge the same, and the lock being entirely concealed is not liable to be broken, or to be in the way when used by horsemen or otherwise, and the trigger being locked is not liable to discharge the lock, by being struck by any article, or by a sudden jar of the gun against anything."

Claim.—"What I claim as my invention, is the combination of the lever with the nipple attached thereto, and sliding hammer, arranged and operated substantially as set forth, by which the nipple is turned and exposed to receive the percussion cap, and the hammer cocked simultaneously by the movement of the lever; the cap being exploded within a chamber inside the stock in a peculiar manner, as set forth, by which the inconvenience arising from flying fragments of the exploded cap, and from smoke, at the moment of discharge, are avoided."

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50. For an *Improvement in Machinery for Dressing Staves;* Asa Broad, Louisville, Kentucky, December 18.

The patentee says,—"The nature of my invention consists in the combination of the several parts of my machine with each other, in such a manner that a shingle will be smoothly dressed on its under side and split from the block at one movement of the carriage; which shingle will fall upon a platform, and be dressed and beveled upon its upper side, during the return movement of the carriage."

Claim.—"What I claim as my invention, is the tilting plate, placed in front of the forward cutter, in the head, in combination with the pin projecting from the beam of the supporting frame, for the purpose of throwing the shavings clear of the cutters, substantially in the manner herein set forth."

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51. For an *Improved Lock for Fire Arms;* Orison Blunt, City of New York, December 25.

Claim.—"What I claim as new, is the mode described of forming the seer as a lateral spring, with a bevel on the part next the tumbler, and the mode of forming the projection on the tumbler with a similar bevel, so that these two parts operate together to discharge the fire arm, by the direct pull of the trigger, and place the parts in a situation to effect a second or successive discharges, by the reverse motion of the trigger; the whole of these movements and effects being produced by the seer and tumbler, without any intervening parts, substantially in the manner described."

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52. For an *Improvement in Drawing Boards;* Henry W. Chamberlain, Pittsfield, Berkshire county, Massachusetts, December 25.

The patentee says,—"The nature of this invention consists in a peculiar mode of securing

to the upper surface of a drawing board, by means of fingers and parts attached to the same, the sheet of paper upon which the figure to be plotted is designed to be delineated."

Claim.—"What I claim as my invention, is the combination of the pointed right angled plates, bars moving over the pins forming the legs on which the board rests, spiral springs, and rod or bale of the form of an ellipsis, for clamping and unclamping the paper as described."

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53. For an *Improvement in Flutes;* Charles G. Christman, City of New York, December 25.

The patentee says,—"My invention consists in certain improvements in the musical instrument called the flute, whereby certain notes are produced which are wholly unknown in the old instrument; and secondly, the improvement in the quality, power, and significance of certain other notes, which, although produced on common flutes, are yet of a very defective and unsatisfactory character."

Claim.—"What I claim as my invention, is, 1st, removing the third and sixth holes from their ordinary place on the old flute to a point farther down, and sounding the notes produced by the said holes by keys operated at the natural fingering place, thereby producing with ease a quality of tone now unattainable, or attained only by great skill, and then with uncertainty.

"2d, I claim producing the true sharp and flat keys by means of the double holes and operating keys, as described."

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54. For an *Improved Process for Making Thin Iron Castings;* Henry Bleecker, William E. Bleecker, and Samuel D. Vose, Albany, New York, December 25.

The patentees say,—"The nature of our invention consists in the manner of using a combined mould in repetition, for the purpose of casting light cast iron plates."

Claim.—"What we claim as our invention, is the process of making thin or light castings of iron, by pouring the metal into a mould of iron that surrounds the article to be cast, entirely with the exception of the gates; said mould being previously smoked on the inside, and provided with a case or knapsack which contains a non conducting material; the whole process being conducted substantially in the manner and for the purposes set forth."

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55. For an *Improved Earth Borer and Elevator;* Phinehas Dow, Philadelphia, Pennsylvania, December 25.

Claim.—"What I claim as new, is the combination of the auger and the circular plate, fixed upon the same shaft, with the cylinder which does not revolve with the shaft, and may be moved along with it, by which I dispense with the force necessary to turn the cylinder, and empty out the excavated material in an easier manner than has heretofore been practised."

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56. For an *Improvement in Cast Iron Car Wheels;* Carmi Hart, City of New York, December 25.

Claim.—"What I claim as my invention and discovery, is the form of the car wheel made with the multiplied and reversed or alternate corrugations of the plates or flanches, as specified; and also the combination of the said plates or flanches with the said spokes, so corrugated or bent, as set forth and described, so as, all together, to prevent straining or cracking of the metal by contraction in cooling, and giving thereby, and by the said combination, greater strength and durability to the cast iron car wheel than has before been attained."

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57. For an *Improvement in Bedsteads;* Benjamin Hinkley, Troy, New York, December 25.

Claim.—"What I claim as my invention, is the union of the side and end rails of a bedstead into a frame entirely independent of the posts, substantially in the manner and for the purpose as set forth."

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58. For *Improvements in Breech-Loading Fire Arms;* George A. Arrowsmith, assignee of Lewis Jennings, City of New York, December 25.

The patentee says,—"My invention relates to that class of fire arms in which loaded balls are used and inserted in a tubular magazine below, and parallel with the barrel, although some of my improvements may be employed without such balls; and my invention consists, 1st, in the employment of a sliding charger, which slides in the tube magazine to force down the loaded balls or cartridges, and operated by a sliding ratchet-rod connected with the bar

of a sliding trigger, the teeth of the said ratchet-rod, as it is drawn back, taking hold of a jointed catch on the charger to draw it down, and with it the charges in the magazine, and, on the back motion, pass by the catch; the charger, during this back motion of the ratchet-rod, being retained by another catch which takes into the teeth of a permanent ratchet lying by the side of the sliding ratchet.

"2d, In making the charger in two parts, one sliding within the other, and the two connected together by a spring, the catch of which is acted upon by the sliding ratchet, being jointed to the inner part and passing through a slot made through the outer part. By this means any difficulty arising from irregularities in the motion of the sliding ratchet, or in the length of the balls, will be avoided, for, as the charger is drawn down, the spring which connects the two parts will be contracted, and the tension of the spring will continue to make pressure on the series of charges, to insure the transfer at the proper time.

"3d, In employing a carrier in the breech of the gun, in combination with the magazine that contains the charges, the said carrier being adapted to receive a charge at each operation, to transfer it at the proper time to the breech of the barrel; and also in combining therewith a sliding breech-pin, which forces the charge from the carrier into the breech of the barrel, and there retains it for the discharge, the said sliding breech-pin being in turn combined with a jointed stop or abutting lever, which, so soon as the sliding breech-pin is forced up to its place in the barrel, is carried up behind the said breech-pin, to constitute an abutment to resist the force of the discharge, and prevent the breech-pin from being forced back.

"4th, In combining with the magazine, and the carrier that elevates or transfers the charge from the magazine to the breech of the barrel, a jointed stop, which, by the motion of the carrier, is thrown across the rear aperture of the magazine, to prevent the delivery of the charges during the time that the carrier is elevated.

"5th, In combining with the receiving chamber, and the carrier that elevates the charge or cartridge, a curved lever jointed to the side of the chamber, with the two ends either curved inwards or provided with projections, so that when the rear end of the charge acts on the curve or projection at the rear end, it shall cause the curve or projection at the forward end to hug the curve of the forward end of the ball or cartridge, to hold it steadily in place until elevated by the carrier.

"6th, In combining with the carrier a catch spring, with a thumb piece that projects beyond the breech-plate, for the purpose of holding down the carrier during the operation of cocking, so that in the event of a non-discharge of the gun, the lock and the parts connected therewith may be operated to discharge the gun without elevating another charge.

"7th, In the use of a spur on the spindle of the cock, when combined with a catch spring on the movable breech-pin, so that by the act of cocking, the spur shall act on the spring catch, to give the breech-pin so much of a back motion as simply to relieve it from the breech of the barrel, that the remaining back motion may be given to it by the trigger-bar, which is thus relieved of the great strain required to liberate or start the breech-pin."

Claim.—"What I claim as my invention, is, in combination with a magazine for containing the cartridges or loaded balls, and which communicates with the barrel, the employment of a sliding charger operated substantially as herein described, for the purpose of forcing the cartridges, as they are required, towards the rear end of the magazine, as described.

"2d, I claim making the charger in two parts, connected by a spring, and working substantially as herein described, whereby any difficulty arising from irregular working or yielding of the parts will be avoided, and by which also the transfer of the cartridges or charges to the carrier is insured.

"3d, I claim combining the carrier, the breech-pin, and the abutting or stop-lever, with the sliding trigger-bar, substantially as herein described, whereby all the movements of all these parts are effected by the motions of the trigger-bar, as described.

"4th, I claim the longitudinal fillet on the trigger-bar, in combination with the pinion having one cog grooved for the passage of the said fillet, substantially as described, by means of which the pinion is made to retain the sliding breech-pin in place while the trigger completes its motion to discharge the piece, and to elevate the stop or abutting lever, as described.

"5th, I claim the stop which prevents the passage of the cartridges from the magazine, when this is combined with the carrier and magazine, substantially as described.

"6th, I claim, in combination, with the receiving chamber and carrier, the lever which hugs and steadies the cartridge or ball therein, substantially as described.

"7th, I claim, in combination with the carrier that elevates and transfers the cartridges or charges, the spring catch, by means of which the carrier can be held down, to permit the piece to be re-cocked without transferring a charge to the barrel, substantially as described.

"And finally, I claim the spur on the spindle of the cock, in combination with the catch on the sliding breech-pin, substantially as described, by means of which the pull on the cock has the effect to withdraw the breech-pin from the breech of the barrel, as described."

59. For a *Tubular Packing for Pistons and Stuffing Boxes;* William Crofton Moat, London, England, December 25; anté dated January 4, 1849.

Claim.—"What I claim as my invention, is the employment of yielding hollow rings and yielding tubing, (of whatever material the same may be composed,) filled with air or gas more or less compressed, for the better packing of the pistons and stuffing boxes of engines worked by steam, air, or gas, as described."

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60. For an *Improvement in Railroad Trucks;* J. W. Moyer, Utica, New York, December 25.

Claim.—"What I claim as new, is the combination of the friction wheels and truck wheels with the truck frame, substantially as described, in which I employ sliding boxes, and connect the parts with springs, while at the same time the axles are made to work steadily in union, and produce the desired effect in a perfect manner."

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61. For an *Improvement in Seed Planters;* Jacob Peirson, Wilmington, New Castle county, Delaware, December 25.

Claim.—"What I claim as my invention, is the peculiar construction of the short axles, as described, in combination with the drilling and seeding machine; said machine containing an intermediate wheel for gearing and ungearing the seed rollers with the cart or driving wheels; said machine also containing a device for simultaneously elevating and dropping all the tubular drills, and likewise containing separate lifting and suspending hook-rods, for raising or suspending one or all of the tubular drills at the same time."

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62. For *Improvements in Wheels for Carriages;* Isaac B. Ward, Camden, Camden county, New Jersey, December 25.

Claim.—"What I claim as my invention, is the manner of employing the screw-bolts between the ends of the cast iron felloes, of the peculiar construction set forth, in combination with said felloes and the ordinary circular wrought iron tire, in the formation of carriage wheels for common roads."

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63. For an *Improvement in Portable Lanterns;* Nathaniel Waterman, Boston, Massachusetts, December 25.

Claim.—"What I claim as my invention, is the lantern constructed with a closed flame chamber, having glass or transparent sides, in combination with an open supplying and chimney tube, extending down through the top of the lantern, and the cap-plate or disk; the whole either with or without the upper frustrum, and applied together and made to operate substantially as specified.

"I make no claim to the use of a reflector in a lantern, as it is ordinarily used, but what I do claim is the combination of the reflector, the lamp, the closed flame chamber, and the chimney over the flame, the same being as specified, in order that the external downward or supplying current of air shall so encircle the upward current of smoke and hot air proceeding from the flame, as to prevent it in a great measure from smoking or soiling the reflector, and thereby cause it to improperly distribute the light which emanates from the flame."

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64. For *Improvements in Machinery for Boring Window Blinds;* John Wiley, New Orleans, Louisiana, December 25.

The patentee says,—"The nature of this invention and improvement consists in arranging within a suitable frame a horizontal frame susceptible of being raised and lowered, and containing a pair of revolving traversing drills, in which the bitts or other instruments for boring are inserted, and arranging on either side of the same a sliding frame, by which the frames and slats of the blind are moved past the bitts or other implements, provided with gauges capable of being altered to correspond with the required distances between the openings to be bored, in such a manner as to bore said openings with accuracy, without the usual measurement, and with a slight expense of power."

Claim.—"What I claim as my invention, is the combination of the graduating frame, spring stops or palls, bent levers attached to the rib by chains or cords, with the sliding frame to which the frame or slat to be bored or mortised is secured, as described.

"I also claim the combination of the traversing arms, projecting from the slides moving in the plates, and provided with the clamp screws for securing the ends of the frames, with the

hollow traversing boxes, provided with clamp screws and springs, and spring rollers, for steadying the frame in its passage, as herein set forth.

"I likewise claim the combination of the elliptical cams secured to the upright shafts, having cog wheels on their upper ends, with the pulleys, in the manner and for the purpose set forth."

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65. For an *Improvement in Apparatus and Process of Rotting Hemp and other fibrous materials;* Lemuel W. Wright, Plainfield, New Hampshire, December 25.

The patentee says,—"The nature of my invention is to treat hemp, flax, China grass, and other vegetable fibrous substances, in such a manner as will more perfectly separate the fibres of such materials for manufacturing them into yarns than has hitherto been done, and consists in macerating such materials in properly constructed vessels with alkaline solutions, at a high degree of temperature, and afterwards in cleaning and drying the material without previously handling it, whereby the fibres would become tangled and unfit for the uses intended."

Claim.—"What I claim as my invention, is the treating of hemp, flax, and China grass, and other vegetable fibrous substances, in preparing them for spinning into fine yarns by steam, alkaline and saponaceous solutions, and drying the same by steam, as described, without handling the same during the process, thereby saving much labor and expense, as well as avoiding loss of material from tangling, matting, &c.

"2d, I claim the combination of the vessels, with their connecting pipes arranged so as to operate upon the hemp, &c., with the steam and solution, in the manner described, or such other arrangements as shall include substantially the same process."

Re-issues for December, 1849.

1. For a *Mill for Rolling Irregular Shapes by means of a Cam Pattern;* John S. Hall, Columbus, Franklin county, Ohio; patented January 30, 1849, re-issued December 4.

The patentee says,—"The nature of my invention consists in connecting with the rollers of an ordinary rolling mill a cam-shaft, with cams thereon, to act upon the boxes in which one of the rollers turn, so as to cause it to rise and fall, to draw bars to any pattern by changing the relative size of the gearing, to make, on a small cam, a sufficient pattern for rolling a long bar, thus making a compact and variable machine by simply changing the gearing, or when the peculiar character of the pattern requires it, making the cam move faster, so as to reduce the pattern."

Claim.—"What I claim as my invention, is the employment of cams, as herein described, for elevating or depressing one of the rollers of a rolling mill, in combination with gearing the same as above set forth, so that a pattern of any length on a cam may be made to affect the surface of any given length of bar in proportional ratio, by change of the relative size of the gearing, by which I avoid, in rolling long bars, any long patterns, difficult to handle and expensive to construct."

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2. For an *Improvement in Fire Proof Safes;* Edward Hall and Joseph L. Hall, Cincinnati, Ohio; patented August 21, 1849, re-issued December 18.

Claim.—"What we claim as new, is joining the interior and exterior cases by the door frame, and connecting both cases with the insulating cement by means of the anchors embedded therein, substantially as herein set forth.

"We likewise claim the employment (in chests so joined) of hydraulic cement, as the insulating substance for fire proof safes or chests, it being stronger when concreted than other cements heretofore used for that purpose; thus making a safe of superior strength and durability, especially when the same is constructed in the manner described."

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3. For an *Improvement in Harvesting Machines;* Francis S. Pease, Buffalo, New York; patented November 14, 1848, re-issued December 18, 1849.

The patentee says,—"The nature of my invention consists, 1st, in the construction and arrangement of a raking platform, attached to a grass or grain cutting machine. The said platform is made double, and the rake teeth which traverse its uppear surface are moved by an arrangement of levers between the top and bottom of the platform, to which motion is given either by hand or by the machine itself. By these rake teeth, the grain, at suitable intervals, is effectually removed from the platform on which it falls when cut.

"2d, In the construction of a rack-bar of wood and iron combined, the stiffness being given by the wood and the strength by the iron, by which combination of materials a rack bar of sufficient strength and stiffness is obtained, yet made lighter and narrower than if constructed entirely of wood, and much cheaper and lighter than if constructed wholly of iron.

"3d, In the construction of rack-teeth of wrought, malleable, or cast iron, with bases sufficiently wide to cover both the top and bottom of the wooden portion of the rack-bar to which they are attached, thus increasing its strength, and protecting it, as well as the cutter-bar which moves within the teeth, from dirt, grass, or grain.

"4th, In the arrangement for attaching the draught, in such manner that the draught can be adjusted to suit any machine to which it is applied."

Claim.—"What I claim as my invention, is alternating the rake, and elevating and depressing its teeth, by devices made, arranged, and operated substantially as described.

"I also claim making a toothed blade case in uniform sections, each section having a tooth cast in one piece with it; the whole being attached to the rack-bar by screws or otherwise, in such manner that if the tooth, or if any section, should get broken, it may be readily replaced by an extra one cast from the same pattern, and kept on hand for that purpose, the rack thus made being equally efficient as a solid case to protect the stock from dirt and obstructions, and can be more easily and cheaply repaired.

"I also claim the manner in which the position of the point of draught is changed, by means of the slides and clamp screws, as set forth.

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4. For a *Method of Attaching Sectional Boats to each other by means of a Rule-Joint;* John Elgar, Baltimore, Maryland; patented November 7, 1835, (extended) re-issued December 25.

Claim.—"What I claim as my invention, is the connecting of canal boats by rule-joints, for the purpose of adapting them to the curvature of the canal, and of steering them by their action upon each other, upon the same principle with that by which a rudder is made to steer an ordinary boat."

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5. For an *Improved Cushion for Billiard Tables;* Abraham Bassford, City of New York; patented December 5, 1848, re-issued December 25, 1849.

Claim.—"What I claim as my invention, is constructing a billiard or bagatelle table cushion, consisting of an air-tight elastic tube, formed upon, and to be used in combination with, a solid but flexible and elastic core, which core shall remain within the tube and be permanently a part of the cushion, such cushion to be used inflated with air whenever extraordinary elasticity is required, or, on the other hand, capable of being used as a solid elastic cushion, whenever, through accident or choice, the tube part is permitted to lose the air by which it was inflated.

"I also claim the application of air or gas, in a tube or tubes of India rubber or other elastic material, to form the cushion of a billiard or bagatelle table, as described. I also claim the mode of extending the tube or cushion in one length around the table, in consequence of which the tube or cushion may be inflated at the same time with one air pump, whereby all parts are equally inflated, and are of equal elasticity."

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6. For an *Improvement in Processes for the Manufacture of India Rubber;* Charles Goodyear, New Haven, Connecticut; patented June 15, 1844, re-issued December 25, 1849.

The patentee says,—"The nature of the first part of my invention consists in curing caoutchouc or India rubber, when combined with, or in the presence of, sulphur, by submitting the same to the action of a high degree of artificial heat at a temperature above solar heat: say from 212° to 350° or thereabouts, whereby this substance becomes so changed in its properties as to resist, without material change, the variations of temperature below that under which it is cured; and also the action of the expressed and essential oils and its other known solvents.

"And the second part of my invention consists in preparing and curing the triple compound of cacouthouc or India rubber, sulphur, and a carbonate or other salt, or oxide of lead, for the purposes pointed out."

Claim.—"What I claim as my invention, is the curing of caoutchouc or India rubber, by subjecting it to the action of a high degree of artificial heat, substantially as herein described, and for the purpose specified.

"And I also claim the preparing and curing the compound of India rubber, sulphur, and a carbonate or other salt, or oxide of lead, by subjecting the same to the action of artificial heat, substantially as described."

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7. For an *Improvement in Felting India Rubber with Cotton Fibre;* Charles Goodyear, New Haven, Connecticut; patented June 15, 1844, re-issued December 25, 1849.

The patentee says,—"My invention consists in combining the fibres of cotton or other substance with a sheet of caoutchouc or India rubber, prepared in any desired manner, by laying a bat or fleece of cotton, or other fibrous substance, on to a previously prepared sheet of India rubber or caoutchouc of the required thickness, and in the green state as it is termed: that is, before the India rubber has been subjected to the curing process, and then pressing the fibres of the fleece into the gum by subjecting the whole to the requisite pressure while the sheet of gum is in a soft state."

Claim.—"What I claim as new, is incorporating the fibres of cotton or other substance with India rubber, by pressing the fibres of a fleece or bat of cotton, or other fibrous substance, into a sheet of India rubber in the green state, without subjecting the fibres, after they have been incorporated, to a stretching or drawing operation, substantially as described."

Additional Improvement for December, 1849.

1. For an *Improvement in Harness Saddles;* Joseph W. Briggs, Cleveland, Cuyahoga county, Ohio; originally patented June 12, 1849, additional improvement annexed December 11.

The patentee says,—"My improvement consists in rigidly connecting flexible pads to the saddle trees, by means of the nuts which secure the terrets in place."

Claim.—"What I claim as my improvement, is a flexible pad rigidly connected with the saddle tree, substantially in the manner herein set forth."

Designs for December, 1849.

1. For a *Design for Stoves;* Daniel F. Goodhue and Charles Guild, Cincinnati, Ohio, December 4.

Claim.—The particular configuration of mouldings around the edge of the doors, and the ornaments on their panels; the external plates of the stove, ornamented substantially as described and illustrated in the drawings; and also the ornamental pattern of legs as shown.

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2. For a *Design for Stoves;* Samuel Hill and William B. Cline, Philadelphia, Pennsylvania, December 4.

3. For a *Design for Cooking Stoves;* Joseph G. Lamb and Conrad Harris, Cincinnati, Ohio, December 11.

4. For a *Design for Stoves;* Dunham, Coller & Sage, assignees of William L. Sanderson, Troy, New York, December 18.

The claims for the above stoves are for the combination and configuration of ornamental designs, &c., substantially the same as described and represented in the respective drawings.

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5. For a *Design for Girandoles;* William F. Shaw, Suffolk county, Massachusetts, December 18.

Claim.—The said design or pattern, or combination of ornamental parts composing the same, in their arrangement in relief, as described and exhibited in the drawings.

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6. For a *Design for Stoves;* William C. Davis, assignee of Hosea H. Huntley, Cincinnati, Ohio, December 25.

Claim.—The combined ornamental design and configuration of stove, substantially as represented in the drawings.

MECHANICS, PHYSICS, AND CHEMISTRY.

On the Manufacture of Iron in South Wales. *By* Hu. L. Damsel, Esq.

To the Committee on Publications of the Franklin Institute.

Gentlemen:—In a recent Journal I saw an article on the state of the iron manufacture in the United States, wherein reference was made to the Welch and Scotch iron works, as well as the position of the British iron trade generally. Being personally acquainted with the Scotch and English works, and having resided for several years at one of the largest and most successfully conducted iron works in the South Wales mineral district, I beg permission to offer a few remarks thereon.

The assertion that "*all* the iron at present manufactured in Wales is of an inferior description in consequence of the inferiority of the ores," is very far from correct. A considerable portion of the iron at present manufactured, is undoubtedly of an inferior description, and adapted only for certain purposes, but the quality of the remainder is not to be surpassed by any manufactured. Welch argillaceous iron stone from the lower measures when smelted without any admixture of hematite, produces an iron of the best quality, as may be seen in bolts manufactured into chains and similar articles. That the admixture of Lancashire or Cumberland hematites with the Welch ores in the blast furnace improves the quality of the iron is what I much question, for of late years these have been imported on a large scale, and at the present time the annual consumption at the Welch works cannot be much under 150,000 tons. Hence if the use of hematites was beneficial to the quality of the iron we might naturally infer that with this large importation it would have improved, whereas I believe that it has, though in but a slight degree, deteriorated.

I was not previously aware that the Welch manufacturer had any cause for apprehending the destruction of his manufacture by the Scotch malleable iron manufacturer, nor do I believe that any one acquainted with the present condition of the Scotch works would entertain such an idea. It is a well known fact that the facility of manufacturing iron from black band is so great that while it exists the Scotch iron-master will keep possession of the American pig iron market, to the exclusion of all other foreigners, but in the article of bar iron there is much to be accomplished before he can successfully compete with the Welch manufacturer in any foreign market, for notwithstanding the low rates at which pig iron is sold on the banks of the Clyde, the majority of the malleable iron works hitherto established in Scotland, have not proved remunerative to their proprietors, nor do existing circumstances favor the presumption that they will ultimately become so.

The exhaustion of the celebrated black band, (from which nearly all of the Scotch pig is made,) proceeds at a rapid rate, and in a few years will be complete, when the manufacturer will have to fall back on his clay band of a low produce, or on the richer but more expensive ores of Lancashire or Cumberland. Now the cost of manufacturing pig iron from either of these ores will exceed the cost of manufacturing it from black

band by fifteen shillings per ton, therefore with the existing rates of labor and profit, the selling price would be sixty-five shillings per ton, which is quite as high as the present selling price of Welch pigs of mixed qualities. But in addition to this increase of cost consequent on the use of clay band, there will be an immense reduction in the make of the blast furnaces, for it is well known in Scotland that a furnace working on clay band cannot make above two thirds the quantity which it could make if working on black band. Hence, with a diminished supply of band, either the make of pig iron will be reduced, or the existing number of furnaces and blowing engines must be largely increased to enable the Scotch manufacturers to produce a similar quantity of iron from the clay band iron stone.

That the black band is rapidly decreasing in quantity is a fact but too well known to the land owners and iron masters in Scotland, since the royalties demanded and paid on it are now from four to five times as high as those on clay band, and this when it is fetched from fields distant ten or twelve miles from the works, whilst clay band could be obtained in their immediate neighborhood.

The advantages which the Welch iron masters have over the Pennsylvania manufacturers are unquestionably very great, and are every day becoming more striking, for independently of the cheaper rate at which they obtain their raw materials, (coal, iron stone, and limestone,) the large size of their establishments, together with the clocklike regularity with which they are conducted, evidently conduce to reduce the cost of manufacturing. It is principally, however, by means of the improvements which have been effected in the manufacture at the Welch works that their proprietors are now enabled to undersell the American manufacturer at his own market, and not, as most persons on the other side of the Atlantic are apt to imagine, from the mere circumstance of their obtaining their fuel at a cheaper rate. Having been actively engaged for several years with one of the leading manufacturers of the place, in a situation affording unusual facilities for obtaining a thorough practical acquaintance with the different departments of an extensive Welch works, and the system on which it is conducted, I am in a position to speak with some degree of confidence on the present condition of the manufacture as compared with its state eight or ten years ago, and as the subject is one of paramount importance to the owners of mineral lands and iron works in the States, I will with your permission proceed to show what has been accomplished in the different departments in the way of improvement or additional economy during that period.

In consequence of the regular dip of the strata in the South Wales mineral basin, and the situation of the old established works at the outcrop, the Welch iron master has to contend with the serious disadvantage of fetching his minerals from a much greater depth than formerly, and he has also in some cases to pay increased royalties. At one time it was very generally imagined that this increase of depth would so enhance the cost of the minerals as to render it impossible to continue the manufacture with profit, but more recent circumstances have shown that although the depth has been doubled and even trebled, yet the improvement in the engines and other motive powers employed, together with the reduction in the quantity of labor necessary to extract a given quantity of coal and iron stone, and

the cheaper rates at which they are afterwards transported to the works, has more than counterbalanced the disadvantages of depth and increased royalties.

The blast furnaces now building or being repaired are very different in their construction and working arrangements from those which formerly existed. By a more judicious application of the blast, the make of the furnace is largely increased with a diminished consumption of coal, and a greatly reduced expenditure for labor, repairs, &c. One furnace lately repaired and altered, now produces the very large quantity of from 220 to 250 tons of forge iron weekly, with a consumption of only twenty-four cwts. of bituminous coal to a ton of iron. And in consequence of the more general use of steam, in lieu of horses, the charge for removing the cinders, a serious charge at several large works, has been largely reduced.

The continental plan of using the gas from the furnace for heating the blast and generating steam for the blowing-engines, is now under trial at several of the large establishments in this and the adjoining county of Monmouth. At some of the old established works possessing inefficient blast engines, and using badly arranged heating stoves, the consumption of coal is very large, from ten to twelve cwts. per ton of pig iron made in the furnace; but in the more recently erected works, with improved engines and stoves, this is reduced to five or six cwts., by using gas this is further reduced to a few pounds per ton, and the services of stokers and ashesfillers are no longer required.

With the improved refinery, now very extensively adopted, the quantity of coal necessary for refining a ton of iron has been reduced from fifteen to seven cwts., and the waste of iron during the process from eleven to two cwts.; while on the other hand the make has been increased from ninety to one hundred and fifty tons per fire per week, thus accomplishing very important reductions on the former cost of refining the pig iron.

The operation of converting the refined metal into *puddle bars*, is one that has undergone very great improvement, as far as regards the waste of metal and consumption of coal, but in other respects it remains much the same. At some forges, however, the workmen use along with the refined iron a mixture composed of rich hematite and other substances with marked advantage to the quality of the iron. Thorneycroft's patent squeezer (a modification of Mr. Burden's) has been tried at several works, but was not generally considered an improvement on the old reciprocating machine. The waste of iron by the patent apparatus was found to be very considerable, whilst the saving in the item of labor did not exceed two pence per ton, and even if it could be erected as cheaply as the old machine, the saving that would accrue by its use could not exceed three pence per ton at the outside.

The rolling mills lately erected at the Plymouth, Cyfarshfa, Dowlais, and Tredegar works are generally admitted to be some of the most powerful and complete of their kind ever erected. Each of these mills contains four trains of rolls, driven by a large high pressure steam engine, with a cylinder sixty inches diameter, and are fitted with saws, cropping shears, and all other gearing of the latest design and in the most substantial manner. The working machinery is made unusually strong, partly with the view of preventing as much as possible all accidental breakages,

and partly with the view of economy in the working expenses. Experience has demonstrated that they are well adapted for this, as their working expenses are exceedingly low, and the utmost regularity, without which no work of any magnitude can ever be profitably conducted, has been obtained.

The improvements which have taken place in the rail department are remarkable for their boldness and ingenuity, one of the most striking is the large quantity of rails which a well arranged and well conducted rail mill can now make weekly. A few years since 200 tons a week was considered a great make, now it is 400 and 500 tons, and even 1000 tons has been made in a large and very powerful rolling mill recently erected near Merthyr Tydvil. The operations of piling, heating, and rolling the rail bars are now conducted on an improved system, by which the loss which formerly occurred from defective rails is reduced to a minimum, and by substituting steam for manual power in the finishing processes of sawing, filing, straightening, &c., the charge for these is reduced to one half, and in some instances to one third, of what was formerly paid.

The merchant bar, slitting, and guide mills, have also participated in the general advancement. Bars and rods are now rolled of lengths varying from forty to sixty feet, being afterwards cut to the required dimensions, by which means the quantity of crops produced, the amount of labor employed, the consumption of coal in the heating furnaces, and the time occupied in rolling a given quantity of bars, are all largely reduced.

Whilst these reductions have been effected in the more important departments, the inferior ones have not been neglected. Fire bricks of a superior quality are now manufactured in immense quantities at a very trifling cost, and the foundries, smith's, machine and other shops, are with but few exceptions on a scale adapted to making, repairing, or altering engines and machinery of the heaviest class in the shortest time and in the most economical manner.

Reduction in the cost of producing the metal being the constant aim of every manufacturer in the district, the majority of them have been led to frame and establish most elaborate systems of book-keeping, by which the expenditure under each department is analyzed in such manner that a mere glance is sufficient to detect and trace to its source the slightest increase of expense, or the least negligence on the part of workmen or agents. In fact the system is carried to such an extent that in some of the large works employing from 3000 to 4000 persons each, the proprietors are perfectly well acquainted with the degree of skill and merit possessed by every workman in their employ.

By these several improvements and reductions the large Welch manufacturers are now enabled to manufacture a ton of rails or other bars from the ore with a consumption of only four tons of semi-bituminous coal, and with a diminution in the quantity of labor, charges for stores, expenses of repairs, &c., of from thirty to fifty per cent. on what was formerly required.

How far these improvements and reductions are applicable to existing American works I am not in a position to say, so large a proportion of them having been but recently erected; presuming, however, that they are generally so, it will not be difficult to ascertain the amount which the manu-

facturers can afford to give for the carriage of their iron to market, and the coal consumed in its manufacture.

The present cost of manufacturing railway bars in this district, (including transit to the nearest shipping port, twenty-three miles from the works,) is about eighty-five shillings per ton. The expense of coals to manufacture a ton of bars from the ore, (four tons at five shillings per ton,) amounts to twenty shillings, which deducted from the above leaves sixty-five shillings per ton for the cost of the ores, and all other expenses incurred in the different processes of the manufacture.

Estimating the present selling price of railway bars of average quality in New York and Philadelphia at forty-five dollars per ton, and deducting seventy-eight shillings, or nineteen dollars and a half, for the cost of ore, labor, and all other expenses incurred by the American manufacturer, at rates twenty per cent. higher than those paid by his Welch competitor, there remains twenty-five dollars and a half to cover the cost of coal and any other extra expense of bringing the iron to market. If the four tons of coal required in the manufacture, and the additional carriage of the iron above the twenty-three miles, cost twenty-five dollars and a half per ton, there can be no profit, but if they cost less, then the difference will exhibit the profit per ton which would accrue to the proprietors; if the works were conducted on the Welch system, at a very moderate calculation the works manufacturing bars through all the different stages from the raw ore, ought to make net returns of ten dollars per ton of rail, or other large bars, made when the selling price is forty-five dollars.

The iron companies whose operations are limited to the conversion of pig into bar iron, at works on the sea board, undoubtedly labor under a greater disadvantage in the higher price of their coal, and it is but too certain that with iron at present rates, a large proportion of them cannot pay, but the case is different with others. If pigs are to be had for twenty-one dollars per ton, the quantity required for producing a ton of bars, twenty-four and a half cwts., will cost twenty-six dollars, and if to this we add six dollars for the labor employed, stores consumed, wear and tear of machinery, &c., during the conversion, at rates one fourth higher than in this district, the expenditure under these heads is thirty-two dollars per ton, which deducted from the selling price of rails, say forty-five dollars per ton, leaves thirteen dollars to cover the cost of the fuel. Two tons of semi-bituminous coal will be sufficient for the operations of refining, puddling, and milling, and works where this is to be obtained for the thirteen dollars, or six dollars and a half per ton, might be kept going without positive loss to their proprietors.

The above calculation refers to railway and common size bars, but in some localities the manufacture of smaller sizes would be attended with greater profit, as these command higher rates in consequence of the extra labor and finish bestowed on them, and imported bars do not always come to market in the best condition. Their selling price would probably average four to five dollars above cost price. It must be borne in mind, however, that the make of such bars from a rolling mill is inconsiderable, probably not above fifty to sixty tons weekly.

It may be necessary for me to remark that the increase of twenty and twenty-five per cent. on the rates paid in Welch works will at first sight

appear too little, but if the whole of the circumstances connected with the American works be taken into consideration, it will be seen that so far as the price of labor is concerned the difference in favor of the Welch manufacturer is very trifling indeed.

In conclusion, permit me to state, that although the iron manufacture of the United States is now in a most depressed condition, by reason of the large importations of foreign iron, yet the time is not far distant when the mineral regions of Pennsylvania and the Western States will produce an abundance of iron, which for quality or cheapness will be far preferable to any imported, and when Americans will be not only independent of foreigners for their supply of iron, but they will be exporting it in the raw and manufactured state to all parts of the globe.

Cardiff, Glamorganshire, South Wales, March, 1850.

For the Journal of the Franklin Institute.

Investigation of the Proper Profile of the Top Beam of a Crane with Moveable Carriage. *By* H. Bacmeister, *Norris Locomotive Works, Schenectady, New York.*

It is desired to so form this profile as to secure these two ends, viz:

I. That the weight may continue at the same level during its movement.

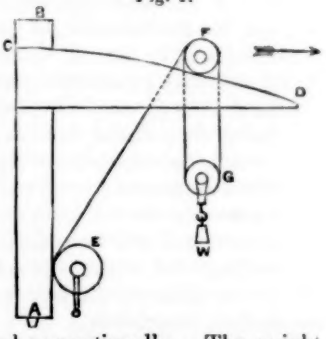
II. That the power and the weight may be every where in equilbrio.

The profile necessary to satisfy each of these conditions will be successively investigated.

I. *Geometrical Condition.*

I. Let AB be the vertical shaft of a crane, to the upper extremity of which is attached the beam CD. The hoisting rope is wound over the drum E, and thence passes to the block and tackle FG. The weight W is suspended from the lower block G, while the upper block F forms a carriage which may be moved along the upper surface of the beam CD, carrying with it the weight W.

Fig. 1.



II. Now suppose the carriage F to be moved in the direction of the arrow, the drum E remaining stationary. The rope EF will be lengthened, and FG be shortened proportionally. The weight W will therefore be raised if the top of the beam CD be horizontal. It will also be lowered when the carriage is moved in the contrary direction.

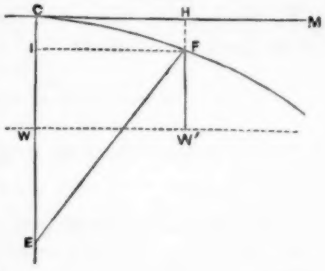
But it is often required in practice that the weight should neither rise or fall during its movements along CD. To attain this end it will be necessary to make the top surface of the beam CD *a curve*, whose nature will now be investigated.

III. To simplify the solution of this problem we will neglect the diameter of the drum (which is very small in proportion to the other dimensions involved) and substitute for it a point E in the middle of that part

of its circumference to which the rope EF is tangent in its different positions.

Let now C be a point situated vertically above E, and representing the centre of the carriage in its first position.—Draw CM perpendicular to EC. Let F be another position of the centre of the carriage. Let WW′, be the respective positions of the weight corresponding to the two positions, C and F, of the carriage. By the conditions of the problem, the line WW′ will be horizontal.

Fig. 2.



Let n denote the number of pullies in the block and tackle, or the number of cords passing to and from the rising block G, (fig. 1.) Then will the elongation of the rope EF, in passing from C to F, be equal to n times the decrease of the distance CW; *i. e.*

$$EF - EC = n\,(WC - W'F.) \qquad (1.)$$

Making now CE the axis of abscissas, and CM the axis of ordinates, and drawing from F the lines FI and FH respectively perpendicular to those axes, we will have

$$EF = \sqrt{\overline{IF}^2 + \overline{EI}^2} = \sqrt{IF^2 + (EC - IC)^2};$$

and, denoting the constant distance EC by a,

$$EF = \sqrt{y^2 + (a - x)^2};$$

$$\text{Also, } WC - W'F = FH = IC = x.$$

Substituting these values in (1,) we get

$$\sqrt{y^2 + (a - x)^2} - a = nx.$$

$$\text{Whence, } y^2 = (n^2 - 1)\,x^2 + 2\,a\,(n + 1)\,x, \qquad (2.)$$

$$\text{Or, substituting } \frac{n^2 - 1}{n - 1} \text{ for } n + 1,$$

$$y^2 = (n^2 - 1)\,(x^2 + \frac{2\,a}{n - 1}\,x,)$$

$$\text{Whence } y = \sqrt{n^2 - 1}\sqrt{x^2 + \frac{2\,a}{n - 1}\,x}, \qquad (3.)$$

Which expression is the equation of an *hyperbola*, the axis of ordinates passing through one vertex of the curve.

IV. To determine the *semi-major axis*, α, and *semi-minor axis*, β, of this hyperbola, we have from (3)

$$\frac{\beta}{\alpha} = \sqrt{n^2 - 1}, \text{ and}$$

$$\alpha = \frac{a}{n - 1}, \qquad (4.)$$

$$\text{Whence } \beta = \sqrt{n^2 - 1} + \frac{a}{n-1} = a\sqrt{\frac{n+1}{n-1}}. \quad (5.)$$

V. To find the position of the *focus*, *i. e.* its distance d from the vertex C, we have the equation

$$d = \sqrt{a^2 + \beta^2} - a = a\left[\sqrt{1 + \frac{\beta^2}{a^2}} - 1\right]$$

Substituting and reducing, we get $d = (n-1)a$, or from (4)

$$d = a \quad (6.)$$

i. e. the focus of the hyperbola coincides with the point E.

When the rope passes over only one pulley, $n = 1$, and equation (2) becomes

$$y^2 = 4ax,$$

The equation of a *parabola*, whose focus also coincides with the point E.

II. *Statical Condition.*

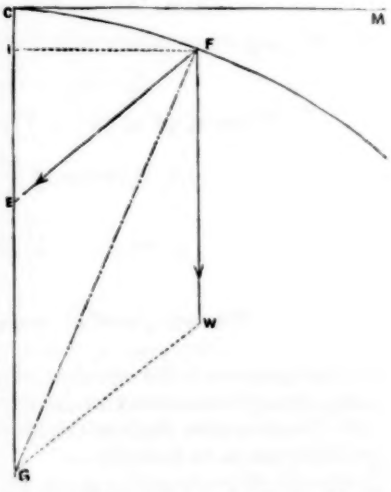
VI. The profile required to satisfy the second, or *statical condition*, enunciated above, will be now investigated.

The rope EF exerts a force at the point F, whose horizontal component tends to move the carriage (and weight) backwards towards C. In order to enable the weight to counteract this tendency by opposing its gravity thereto, the top of the beam must be a *curve*. We are now to investigate this curve of equilibrium.

VII. As before, let CM and CE, be the co-ordinate axes, F the centre of the carriage in a certain position, CE = a, and n = number of pullies.

The vertical force, acting at F, equals the weight W. The oblique force acting at the same point equals the tension of the rope EF = $\frac{W}{n}$. The two forces are therefore to each other as $1 : n$. Their direction is known, and their resultant is the diagonal of their parallelogram.

Fig. 3.



Thus, in figure 3, representing the oblique force by EF, and the vertical force by FW = EG, the diagonal FG is the resultant required.

The *condition of equilibrium* now is that the curve of the beam shall be normal, at the point F, to this resulting diogonal. We will now express this analytically.

VIII. As before, let CI = x, and FI = y, be the co-ordinates of the point F. Since FG is normal to the curve at the point F, GI is the sub-

normal for the same point, and is expressed by the product of the ordinate into the differential coefficient, *i. e.* $GI = y \frac{dy}{dx}$.

$$\text{But } GI = GE + EI, \qquad (7.)$$

$$\text{And } GE = n \times FE,$$

$$\text{And } FE = \sqrt{FI^2 + IE^2} = \sqrt{y^2 + (a - x)^2},$$

$$\text{Also, } EI = a - x.$$

Substituting these values in equation (7) we get

$$y\,dy = (a - x)\,dx + n\,dx\sqrt{y^2 + (a - x)^2}, \qquad (8.)$$

Which is the *differential equation* of the curve of equilibrium and is now to be integrated.

IX. Separating the variable quantities under the radical, and reducing further by putting

$$a - x = z$$

$$y = z\sqrt{v^2 - 1}, \qquad (9.)$$

We obtain, after an easy reduction,

$$(v + n)\,dz + z\,dv = 0.$$

$$\text{Whence } \int \frac{dz}{z} + \int \frac{dv}{v + n} = c,$$

And $vz + nz =$ a certain constant quantity to be derived from the conditions of the problem, and here $= a + na = (n + 1)\,a$.

Replacing v and z by their values from (9) we obtain, after an easy reduction,

$$y^2 = (n^2 - 1)\,x^2 + 2\,a\,(n + 1)\,x. \qquad (10.)$$

X. From the perfect identity of equations (2) and (10) it appears that the conditions on which we based the geometrical solution of this problem as enunciated in § II, are identical with the conditions of equilibrium as given in § VII. That this is not merely an accidental but a necessary result, may easily be inferred from the consideration that the condition that the weight suspended from the carriage shall neither rise above nor fall below its original position, is nothing more nor less than the condition of equilibrium itself.

For the Journal of the Franklin Institute.

Who Invented Parker's Water Wheel?

This is the title of a short article in the Practical Mechanics' Journal for March, published in Glasgow, the substance of which is as follows:— "I observe in the *Civil Engineer and Architect's Journal*, an article copied from the *American Franklin Journal*, giving an account of what is there called "Parker's Water Wheel." The improvement claimed in this article is the invention of Koechlin & Co., of Mulhause, and is patented by

them. A description accompanied with drawings and several valuable tables containing the results of a series of experiments made upon two of their wheels, to determine their effective working power, was read at a meeting in August, 1843, of the Societè Industrielle. This description and tables, together with the reports of the committee appointed to investigate the merits and conduct the experiments, is published in the Transactions of the Society, vol. XVIII." Then follows a short piece of that coarse abuse in which British periodicals used to be in the habit of indulging towards Americans, but which, for some time past, very shame has banished from their respectable journals, and which, no doubt, would have had the pen drawn through it had it met the eye of the editor of the Practical Mechanic.

To such language, no one will expect us to reply, either in defence or by recrimination, be the opportunity ever so tempting; on the contrary, we might with propriety refuse to reply even to the facts alleged in such attacks. We shall, nevertheless, not take advantage of this privilege, but reply strictly, that a description of the Koechlin turbine, taken from the Civil Engineer and Architect's Journal, will be found in our Journal for 1845. (*3d series, vol.* ix, *p.* 222.) The analogies to Parker's wheel are the helical sluice (*d* of the figure) and the contracted air-tight box. The first of these was patented by Austin and Zebulon Parker in October, 1829, (see Journal Franklin Institute, 2d series, vol. v, p. 33,) and the latter by Zebulon Parker and Robt. M'Kelvey, administrators of Austin Parker deceased, on 27th June, 1840, (Journal Franklin Institute, 3d series, vol. ii., p. 135,) or three years before the paper describing Koechlin's turbine was read before the Societè Industrielle of Mulhause. We think this explanation will be found sufficient as to the question who invented Parker's wheel; and we hope that the editor of the Practical Mechanic's Journal, will republish it for his own sake and for the information of his readers. As to the rest, Mr. J. G. may think it shows contempt for the Americans to affect ignorance of what they have done or are doing, but such ignorance excites no feeling here except that of regret for him who exhibits it.

F.

New Process for extracting Sugar from the Sugar-Cane. By M. Melsens.*

The following account of the new and important method of extracting sugar from the sugar-cane, is abridged from the first of two long articles recently published in the *Courier de l'Europe.*

The great difficulty which has been experienced up to the present time in the preparation of sugar, has been owing to the rapidity with which it, when dissolved in water, alters by exposure to the air in hot climates.—It must, however, be clear, since the cells of the sugar-cane are themselves full of sugar dissolved in water, and this solution can be kept for a long time in them, without undergoing any alteration at all, that if the same conditions which exist in nature could only be obtained in practice, there is no reason why an artificial solution of sugar may not be kept unaltered for a considerable space of time; or in other words, why water should not

* From the London Chemical Gazette, January 15, 1850.

be used for the purpose of dissolving the sugar out of the crude juice expressed from the cane.

The difficulties, indeed, are not owing to the sugar or to the water, but to the air, and the ferments produced by its action on the crude sap of the sugar-cane. The object of M. Melsens was, then, to exclude the air from the sap when extracted from the cane, and to prevent the formation of any ferments which might change the character of the saccharine matter.—This he has succeeded in doing by availing himself of the well-known affinity of sulphurous acid for oxygen gas. Sulphurous acid, however, alone was found not to answer the purpose; the sulphuric acid, produced by the absorption of oxygen by sulphurous acid, acting on the sugar, converts it into grape-sugar. This difficulty has been overcome by using sulphurous acid combined with a powerful base, which, as the sulphurous acid is converted into sulphuric acid, combines with the latter and forms an insoluble salt.

The acid sulphites, and more especially the bisulphite of lime, were employed by M. Melsens for the double purpose of preventing fermentation by the action of the sulphurous acid, and of neutralising the sulphuric acid as fast as it formed by means of the lime.

Sugar-candy dissolved in cold water containing bisulphite of lime, even in excess, crystallized entirely, and without undergoing any change, by spontaneous evaporation, at a low temperature. Several other experiments of the same nature, but differing in their details, always gave the same result; in each the sugar crystallized out by spontaneous evaporation, without any loss either in quantity or in quality, and without any appearance of molasses. In these experiments, the sugar dissolved in water, containing bisulphite of lime in excess, was boiled, and then left to evaporate, sometimes after being filtered, sometimes without any filtration at all.

From the experiments which M. Melsens has made with bisulphite of lime, it is probable that if a cold solution of this salt were to be poured on the sugar-cane grinder, so as to mix with the juice the moment it is expressed from the cane, the sugar might be kept for some time, and might be exposed to the heat necessary for its clarification without any sensible loss or deterioration.

But this same salt also possesses the property of coagulating, at a temperature of 212°, milk, white of egg, blood, and yolk of egg mixed with water. At a temperature of 212°, bisulphite of lime acts as a clarifier.—It separates the albumen, caseum, and other similar azotized matters which are found in the sugar-cane. This separation is effected without appreciable loss in the quantity, or deterioration in the quality, of the sugar.

Bisulphite of lime, moreover, rapidly and tolerably effectually bleaches the colored substances found in the sugar-cane; it prevents the formation of other colored matters produced by the action of air on the pulp of the cane; it also stops the production of those which are formed during evaporation, and above all of those which require for their development the joint action of air and a free alkali.

It seems that colored substances, which, under ordinary circumstances, are formed spontaneously by the exposure of the pulp of the sugar-cane to the air, never make their appearance when bisulphite of lime is employed. By evaporating, at a low temperature, bisulphite of lime mixed with—1,

a common solution of sugar; 2, the crude sap of the sugar-cane; 3, the juice of beet-root; no coloration was produced. By an evaporation of the same substances at a high temperature, the coloration was scarcely visible; indeed, with red beet-root the color was completely destroyed, and the sugar obtained was perfectly white.

It seems, then, that bisulphite of lime can be employed in the extraction of sugar:—1st, as an antiseptic, preventing the production and action of any ferment; 2nd, as a substance greedy of oxygen, opposing any alteration that might be caused by its action on the juice; 3rd, as a clarifier, coagulating at a temperature of 212° all albuminous and other coagulable matters; 4th, as a body bleaching all pre-existing colored products; 5th, as a body opposing itself in a very high degree to the formation of colored substances; 6th, as a base capable of neutralising any hurtful acids which might exist or be formed in the juice, and substituting in their place a weak inactive acid, namely, sulphurous acid.

M. Melsens is of opinion that sugar can be obtained from the sugar-cane with no other source of heat than a tropical sun, excepting only for the purpose of clarification; indeed, the bisulphite of lime prevents the crude juice of the cane, or the syrup obtained therefrom, from undergoing any changes; great rapidity in the process of crystallization, indispensable at present, becomes by using this salt unnecessary; and more than this, the quantity of sugar which is now lost in the bagasse, in consequence of the impossibility of washing it out unchanged, can be all collected by being dissolved in water charged with bisulphite of lime.

The only objection that can be made to the above process is, that the sugar obtained by means of bisulphite of lime has a sulphurous taste; this is true, but the taste is completely lost—1st, by crushing the sugar and exposing it to the air, whereby the little sulphite of lime which there may be is converted into a tasteless sulphate; 2nd, by exposing the sugar to an atmosphere containing ammonia; if this is done the sugar acquires a very agreeable flavor of vanilla, but is apt to become a little discolored; 3rd, by clarifying it until it loses 10 per cent. of its weight; by this process a pure white sugar can be obtained, which will bear comparison with any sample produced at present. The last is the process recommended to be used on a large scale. The quantity of sugar fit for the market which can be obtained from the sugar-cane by adopting bisulphite of lime, as above recommended, is at least double that obtained by the usual processes.

In consequence of M. Melsens having made all his experiments on the sugar-cane at Paris, and therefore on a small scale, he is not able to state how bisulphite of lime can best be used in the large colonial sugar manufactories, but is compelled to leave the application of the principles on which his method depends to the intelligence of the manufacturers themselves.

In the preparation of beet-root sugar bisulphite of lime is quite as useful as in the extraction of cane-sugar; the way in which it is to be employed in the former is fully explained in the second article published in the 507th number of the *Courier de l'Europe*, to which we must refer those among our readers who desire any further information on the subject.—*Gard. Chron., Dec.* 15, 1849.

For the Journal of the Franklin Institute.

Description of the United States Steamer "Susquehanna."

This fine naval steamer, one of the four now building for the Government, was launched on the 13th of April from the Philadelphia Navy Yard. As she is one of the largest war steamers belonging to the Navy, (the other of the same size being the "Powhattan,") her dimensions will be of interest to the readers of the Journal.

	Feet.	Inches.
Length on deck,	256	6
Breadth of beam,	45	
Depth of hold,	26	6
Draft of water when loaded,	19	

Tonnage, 2436 tons.

She is to be propelled by two inclined engines, the frames being of wrought iron.

	Feet.	Inches.
Diameter of cylinders,	5	10
Length of stroke,	10	
Diameter of air pump,	4	
Length of stroke,	3	4
Diameter of condenser,	6	3
Height of "	3	3
Diameter of water wheels,	31	
Width of "	9	6

Number of arms in each centre, 26, having 26 split paddles, forming 52 of 17 inches by 9 feet 6 inches.
Number of flanches in each wheel, 3.
Whole number of arms in each wheel, 78.
Size of arms, $5\frac{1}{2} \times 1\frac{1}{4}$.
Diameter of shafts in main journal, 18 inches.
" connecting rods, in neck 7 inches, in centre $9\frac{1}{2}$.
" piston rod, 7 inches.
Steam passages in cylinders, $42 \times 8\frac{1}{2}$.
Area of foot valve, 752 inches.
Four copper boilers, 15 ft. 9 in. long, 14 ft. 1 in. wide, 12 ft. 9 in. high.
Number of furnaces in each boiler, 3.
Length of grate, 6 ft. 6 in.
Diameter of chimney, 8 ft. 4 in.
Height of " 45 ft. 9 in.

The engines were designed by Charles W. Copeland, Esq., and constructed by Murry & Hazlehurst, of Baltimore. The whole will be completed by the 1st of August. B.

Translated for the Journal of the Franklin Institute.

On the Elliptical Double Refraction of Quartz.

At the session of 4th February of the Academy of Sciences of Paris, M. Jamin read a memoir upon the elliptical double refraction of quartz, in which he gave an account of a series of experiments upon a section of quartz cut obliquely to the axis, for the purpose of verifying the ingenious hypothesis, by means of which Prof. Airy had proposed to account for the phenomena which appear under these conditions. The following conclusion is very interesting in connexion with the memoir of M. Cauchy alluded to at page 280.

"Simple as it (the hypothesis of M. Airy) is, probable as it appears, this hypothesis is, nevertheless, not true; it satisfies the limits of the problem but is always disaccordant with experiment in intermediate cases.

"I then requested M. Cauchy to apply his general theory of double refraction to rock-crystal; he agreed to devote his attention to the problem, and was lead to formulæ of great complication. But, by introducing the restriction that the angles of refraction shall be very small, they were reduced, for a first approximation, to a very simple form. As experiment had shown me that the particular phenomena of quartz cease to be visible at a small distance from the axis, I accepted this first approximation, as likely to be sufficient, and found that the formulæ were admirably in accordance with experiment.

"I ought, however, to explain, that the experiments which I submit to the Academy have been finished for more than a year; and that when I requested M. Cauchy to develope the theory of them, I did not communicate to him the results to which I had come; it was, therefore, without any experimental action, and without any guide except himself, that M. Cauchy found the solution of the problem; and when it was communicated to me, a few hours of calculation were sufficient to show that it reproduced the experiment exactly, without it being necessary either to modify the formulæ to render them exact, or to recommence the experiments with the desire to make them coincide with the theory.

"Plates of quartz placed in the path of light polarized rectilinearly or circularly, offer, as is known, very various appearances, which M. Airy had succeeded in explaining, but which we can now reproduce and of which we can now calculate all the peculiarities; we may, therefore, consider the complicated phenomena which crystals of quartz present, as being entirely known."—*Comptes Rendus de l'Acad. Sci., Paris, tom.* xxx. *p.* 99.

For the Journal of the Franklin Institute.

Description of the Steamship "Atlantic."

This gigantic steamer, the first finished of Collins' New Liverpool Line, made a trial trip on the 20th of April, and performed to the satisfaction of all on board. A good deal of interest was felt as to the success of her boilers, but they are reported to have given an abundant supply of steam with a moderate amount of fuel. The boilers are four in number, back to back, having one common chimney. Each boiler is 22 feet 2 inches long, 13 feet 8 inches wide, and the same in height in front. There are two rows of furnaces, one above the other, or eight furnaces to each boiler; the lower furnaces have grates 7 feet 4 inches long, and the upper ones are 5 feet 4 inches long. Back of the bridge-walls are 37 rows in depth of 2-inch tubes, placed vertically, through which the water circulates. The external surface of these tubes, in connexion with the water legs or division between the furnaces, constitutes the principal amount of fire surface. The tubes are 5 feet and 4 feet 6 inches in length, about equally divided, or one-half of each. The engines are two in number, with side levers; cylinders 95 inches diameter, 9 feet stroke; water wheels 36 feet diameter, 12

feet 6 inches wide, and, with 1000 tons of coal on board, carrying 10 lbs. steam at sea, and cutting off at half stroke, made 12 revolutions.

The engines are the best specimen of marine engines yet produced in this country, and the frames are particularly worthy of note, as being braced in a very secure manner. They were designed and built by Stillman, Allen & Co., Novelty Works, New York, and the boilers were designed by Mr. John Faron, Jr., recently deceased, who was Chief Engineer of the line.

The hull is a splendid specimen of naval architecture, and has never been surpassed for strength or beauty. There is a diagonal frame-work of iron extending from the bilge to the upper deck, and running the whole length of the vessel. It is composed of bars 45 feet long, 6×1 inches, placed at a distance of 4 feet apart, and let into the timbers their thickness. This iron frame-work is firmly secured to the wooden frame, so as mutually to support each other. The extreme length on deck is 290 feet, breadth of beam 46 feet, depth of hold 32 feet, and by Custom House measurement she is 2900 tons. The finish of her cabins can hardly be described; it is of the richest character, and composed principally of rose wood, satin wood, oak, &c., inlaid.

She has accommodations for 200 first class passengers, and besides her fuel, can carry 1000 tons of goods. Great expectations are entertained in relation to her speed, but I am glad to see that her owners and builders have not countenanced any high wrought statements. A few trips will soon test everything, and I have no fear but she will be a credit to her builders, whether in speed she surpasses the new Cunard steamers, "Asia" and "Africa," or not.

The cost of the "Atlantic" is $550,000, one-half of which sum was expended on her machinery. She is commanded by Captain James West, formerly of this city, and the 1st, 2d, 3d, and 4th officers are past midshipmen of the U. S. Navy. The Chief Engineer is Mr. J. W. Rodgers, one well known in his profession, and he has six assistants.

The "Pacific" will succeed the "Atlantic" in about two months; her machinery is building at the Allaire Works. The "Baltic" and "Artic" will not be ready before fall. B.

Translated for the Journal of the Franklin Institute.

Note on the Superficial Conducting Power of Crystallized Bodies, for Electricity of Tension. *By* M. G. WIEDEMANN.

The method used by the author consists in using a plate of the crystal to be examined, upon the centre of which he rests a metallic point which is made to communicate with the positive knob of a Leyden jar. The surface of the crystal being covered with a light powder, such as lycoperdium, when the point is charged, the powder is seen to be brushed away from a certain portion of the surface adjacent to it, if the crystal be a bad conductor such as gypsum; when, however, the crystal is a better conductor, as in the case of feldspar, the powder around the point adheres more strongly, and by tapping the crystal carefully the rest of the powder may be discharged, while the portion around the point remains. This electrified area

has its dimensions unequal in different directions. The results are independent of the form of section of the point, for in using points of different sections, the figures on the glass remained the same. With a plate of glass, the figure was a circle. The following are M. Wiedemann's general conclusions:

1. The direction of the figure is independent of the striæ which mark the surface of certain crystals.

2. With calc-spar, arragonite, apatite, and tourmaline, the figure is elliptical, the major axis being parallel to the principal axis of the crystal. With other crystals which do not belong to the regular system, it is perpendicular to it. In regular crystals the figure is a circle, as upon glass.

3. Assuming that this major axis coincides with the direction of greatest conducting power, we may lay down the following conclusion, that "in negative crystals the direction of greatest conducting power coincides with the principal optical axis of the crystal; in positive crystals, it is at right angles to it, excepting the case of feldspar, which appears to follow the opposite law." M. Wiedemann explains that these results were published in Germany before the date of the experiments of M. de Senarmont upon the same subject.—*Comp. Rend. Acad. Sci. Paris, tom.* xxx. *p.* 110.

Translated for the Journal of the Franklin Institute.

Note on a Means of Causing an Electrical Machine to Work in all Weathers. By M. Munch.

This means consists in tracing a slight line of tallow on each side of the plate from the centre to the circumference. If this be done in weather when scarcely anything can be got from the machine, it will be seen, from the first turn of the plate, that every thing is changed and that it will perform perfectly. If the glass pillars which support the conductor are not covered with a coating of gum-lac, tallow should also be applied lightly to them, and then rubbed off with a dry cloth.* It is evident that in these operations the object is to interpose an imperceptible coating of fatty matter between the surface of the glass and the ambient air charged with aqueous vapor.—*Comp. Rend. Acad. Sci. Paris, tom.* xxx. *p.* 47.

On Some Phenomena of Reduction: a New Method of Separating Iron from its Compounds. By J. A. Poumarede.†

Some years ago the author examined the action of some metals, and especially that of zinc, upon metallic solutions. On bringing together solutions of iron, cobalt, nickel, and manganese, the decomposition of the water and the disengagement of hydrogen appeared to him not to be produced by the zinc, but by a certain quantity of the dissolved metal, precipitated by that antagonism which is always exhibited when two different radicals occur in the presence of a limited amount of oxygen, coating the

* New Edinburgh Encyclopedia, (Am. Ed.) Vol. viii., p. 334, where the authority of Mr. Nicolson is cited for this mode.

† From the London Chemical Gazette, April 1, 1850.

reducing metal, and producing in this manner a galvanic element. To demonstrate that such might really be the case, it was necessary to establish that this reaction, which might be expressed by the following equation, $2(Fe^2\,O^3, 3SO^3) + Zn^3 + HO = Fe^3\,O^3, 3SO^3 + Zn^3\,O^3, 3SO^3 + FeO + H$, might also take place in the following manner:—$2(Fe^2\,O^3, 3SO^3) + Zn^3 + HO = Fe^3\,O^3, 3SO^3 + Zn^3\,O^3, 3SO^3 + HO + Fe$.

The author succeeded, in fact, in doing this by quickly removing the precipitate of reduced metal from the zinc, and so preventing the formation of a galvanic circuit; instead of the hydrogen there now appeared a corresponding quantity of metallic iron. After further examination of these phenomena, the author has not attained the desired result in a scientific point of view; he has, however, discovered the following three methods for the reduction of iron:—

1. *Salts of the Protoxide of Iron*, under the above mentioned circumstances, part with half their oxygen at a slight elevation of temperature, the corresponding amount of iron being separated in a metallic form. Such iron can be prepared at very little cost, and it will undoubtedly find some useful application in the arts. It is purer than the ordinary iron of commerce, has the usual color, and all the other properties of iron, and the specific gravity of 7·50.

2. *Protochloride of Iron* may be reduced by zinc in the state of vapor. The iron so obtained is well adapted for the reduction of a number of other protochlorides; it always forms dendritic crystals, among which occur here and there hollow tetrahedra. Its specific gravity is 7·84, which is nearly the same as Broling assigns to iron melted into bars. Its purity is so great that it decomposes water only imperceptibly in dilute sulphuric acid.

3. The carbon, whose influence the author had distinctly recognized in the previous reduction, has been especially examined as regards its reducing action, and application made of well known facts, in which he assumes the views brought forward by Leplay and Laurent on cementation to be proved.

When peroxide of iron (colcothar) or protocarbonate of iron is heated with charcoal, the oxide of iron being packed in shallow sheet iron vessels with intervening strata of carbon placed upon iron wire sieves, in a cast iron cylinder placed vertically in a reverberatory furnace, and the upper part of which is connected by a tube of sufficient length with the atmosphere or the requisite apparatus, and it is now heated to a red heat; there is observed during the entire operation a disengagement of carbonic oxide, which may be immediately employed for other reductions. The peroxide or protocarbonate of iron is converted into porous iron, which is not pyrophosphoric and has all the properties of a very pure iron.

To explain this behaviour, we must admit, according to Leplay and Laurent, that the atmosphere of the apparatus first produces with the carbon a quantity of carbonic oxide, which reacts upon a corresponding amount of peroxide of iron, and furnishes carbonic acid; this is next reduced by the charcoal to carbonic oxide, which then constitutes twice the amount first present. In this manner, after a short time, the oxide is placed in a reducing atmosphere. By this method the author has reduced a number of other compounds, for instance the alkaline and earthy sulphates.—*Comptes Rendus*, xxix. *p.* 518.

Translated for the Journal of the Franklin Institute.

Premiums Awarded for the Introduction of Improved Methods in Arts regarded as Unhealthy.

At their session of 4th February, 1850, the Academy of Sciences of Paris, on the recommendation of a committee appointed to report upon "various inventions intended to render an art or profession less unhealthy," awarded the following premiums.

2500 francs to M. Leclaire for "the preparation on a large scale of zinc white, and its introduction into house-painting by means of a drying oil prepared by manganese."

2500 francs to M. Rocher, "for an economical apparatus for distilling sea-water on board of ships, using the heat of the culinary apparatus."

Translated for the Journal of the Franklin Institute.

Double Piston Steam Engine. By M. Paltrineri.

"In this machine the steam cylinder has two pistons which move in opposite directions; a single valve box suffices to lead the steam at one time to the middle of the cylinder, when the pistons are to be driven outwards, at another to the ends, when they are to be driven inwards. The author points out various applications of this system, for locomotives, and for steam ships of great power, and he has succeeded in some of them in making very simple arrangements, which allow the reduction of the dimensions and consequently of the weight of the apparatus."—*Recueil de la Société Polytechnique, June*, 1849.

On the Heat of the Vaporization of Water. By J. P. Joule.*

The object was to point out the complex nature of the heat hitherto taken from the latent heat of steam. In the exact experiments of Regnault 965° was found to be the quantity of heat evolved in the condensation of steam saturated at 212°; of this quantity 75° is the heat due to the *vis viva* communicated by the pressure of the steam, leaving 890° as the true heat of vaporization of water. In a perfect steam engine supplied with water at 212°, and worked at atmospheric pressure without expansion, 965° will be the heat communicated from the fire to the boiler, 75° will be the heat utilized by conversion into force, and the remainder 890° will be the heat given out in the condenser.—*Proc. Brit. Assoc.*

Fire Bricks for Furnaces.†

The *Morning Chronicle* Commissioner, in his letter from Merthyr Tydvil, gives an account of a curious branch of industry carried on there—namely, the making of fire bricks for lining the furnaces, and, indeed, for all other purposes where a material is required capable of withstanding intense and long continued heat. There are two substances, found in abundance in

* From the London Civil Engineer and Architect's Journal, for November, 1849.

† From the London Artizan, for April, 1850.

the coal and iron districts, which have the property of resisting in a high degree the action of fire; the one is termed "fire clay," a stratum of which is often overlaid by coal—the other is the "farewell rock," a species of stone composed of quartz, blended together by a silecious cement. Upon this rock repose the whole of the coal and iron stone "measures." The bricks are used for lining the interior of the blast furnaces down to "the hearth," or receptacle of the fluid iron, which is always constructed of the stone. Experiments on bricks made of this fire clay have satisfactorily shown that its capacity of resisting heat is fully equal to that of the better known, and more generally used, fire bricks of Stourbridge. The manufacture of fire bricks at these works is exclusively carried on by women, and a more humiliating and ungenial occupation for the sex is hardly to be found through the entire range of our industrial economy.

For the Journal of the Franklin Institute.

Explosion of a Locomotive on the Chartres Railroad, France.

The numerous explosions of steam engines, stationary and locomotive, which have recently occurred, and the very fatal effects of some of them, have strongly attracted the public attention for the moment, and it is hoped may convince the community of the necessity of requiring some precautions in the use of these valuable but dangerous motors.

The laws regulating the building and use of steam engines in France appear to be excellently devised for the purpose of proper restraint, and what is still better, and more uncommon upon our side of the ocean, are strictly enforced. Every explosion becomes the object of a report made by the Government Engineer of the Department to the Central Committee of Steam Engines, and if it be found that any of the precautions required by law have been omitted, the penalties are promptly and rigidly enforced. These reports are from time to time published in the "Annales des Mines," and furnish valuable documents for the study of those who are interested in this matter.

Such a report, upon an explosion of a locomotive on the Chartres Railway, is to be found in Vol. XVI., (4th Livraison for 1847, p. 81,) and we note it particularly, as reminding us of a feature which we noted in the explosion of the locomotive "Richmond" on the Reading Railroad, in 1844. (*Journ. Fr. Inst., 3d series, Vol.* IX., *p.* 16.) In fact, M. Sentis, the Government Engineer who made the examination and report, states (p. 87) "that the bridge-bars were not so long as the top of the fire-box, but stopped 5 centimetres (1·97 in.) short of the edges of the upper plate. Now it was precisely at the ends of these bridge-bars that the rupture (of the crown of the fire-box) took place." This is assigned as the main cause of the explosion, by which we understand M. Sentis and the Central Committee to mean, merely that it determined the place of rupture. There was also reason to believe that the valve was screwed down, and the water line had been suffered to fall below the crown of the fire-box.

In a note, M. Sentis quotes a similar case, in which the line of fracture was determined by short bridge-bars, in the case of a locomotive made by Fairbairn, of Manchester, which exploded in 1845. In the case of the

"Richmond," the bridge-bars "terminated about ¼ in. short of the bend by which the crown is joined to the sides." This is a fault of construction against which our builders should be watchful, as we can scarcely conceive of a mistake more likely to lead to fatal results. Ed.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, April 19th, 1850.

Thomas Fletcher, Vice President, in the chair.
George J. Zeigler, Recording Secretary, *pro tem.*
John F. Frazer, Treasurer.

The minutes of the last meeting were read and approved.

Letters were read from Mrs. Sarah Peters, respecting a School of Design for Females; from Wm. Peter, Esq., British Consul, respecting the Exhibition of the Works of all Nations, to be holden in London on May 1st, 1851; and from Mr. Angus N. Macpherson, accompanying his donation of Specimens of Ores from Valley Forge, Chester county, Penn.

Donations were received from The Statistical Society, and The Royal Astronomical Society, London; La Societié Polytechnique, and La Societié d'Encouragement pour l'Industrie Nationale, Paris; Hon. Jos. R. Chandler, U. S. Congress; The Mercantile Library Association of St. Louis, Mo.; W. Milnor Roberts, Esq., Marion, Ohio; Prof. John F. Frazer, Frederick Graff, Esq., Dr. Thomas S. Kirkbride, Samuel J. Reeves, Esq., and Angus N. Macpherson, Esq., of Philadelphia.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of receipts and payments for the month of March.

The Board of Managers and the Standing Committees reported their minutes.

The following Standing Committees reported their organization, by appointing their Chairmen, and fixing the time for holding their stated monthly meetings:

Committee on Models.—H. P. M. Birkenbine, Chairman, 2d Monday Evening.

Committee on Arts and Manufactures.—James C. Booth, Chairman, 2d Monday Evening.

Committee on Minerals and Geological Specimens.—Chas. M. Wetherill, Chairman, 2d Wednesday Evening.

New candidates for membership in the Institute (4) were proposed, and those proposed at the last meeting (3) were elected members of the Institute.

On motion, the letter from Mrs. Sarah Peters on the subject of a School of Design for Females was referred to the Board of Managers of the Institute, with power to take order.

On motion, a special vote of thanks was presented to A. N. Macpherson, Esq., for his valuable donation of Specimens of Lead and Copper Ore.

Dr. Wetherill submitted the results of several analyses made by him:—

I. Specimen of Graphite, from Bucks county, Pa. Lustre highly metallic, soft, crystallized in scales; specific gravity 2·29; an excellent conductor of electricity; burns with great difficulty before the blowpipe; burned very imperfectly in a reduction tube of Bohemian glass heated to redness in a current of oxygen, leaving a reddish-brown ash; with chlorate of potassa it burned completely. The qualitative analysis gave traces of iron; no lime. The carbon was determined by combustion with chromate of lead; 0·36025 grammes of the graphite gave 1·2595 carbonic acid and 0·004 water, corresponding to 95·35 per cent. carbon and 0·09 hydrogen, which latter falls below the errors of analysis.

II. Specimens of Cinnabar from California. No. 1.—Steel gray, crimson red streak; specific gravity 6·03. It contains sulphuret of mercury, silica, iron, and lime. 2·7057 grammes gave, on analysis, 1·6292 Hg., or 60·21 per cent.; 3·0477 grammes gave, on analysis, 1·8382 Hg., or 60·31 per cent. No. 2 was poorer, containing more flint; 2·0258 grammes gave 0·9250 Hg., or 45·66 per cent. These were both surface specimens.

III. Specimen of Lignite from Oregon, from the same locality as that the analysis of which was given by Prof. Frazer at the last meeting. The relative proportion of carbon to hydrogen was determined by combustion with chromate of lead. 0·471 grammes, dried at 100° C., gave 1·2595 CO_2 and 0·212 HO, corresponding to 72·93 per cent. carbon and 4·99 hydrogen. This is a perfect lignite, as is shown by its appearance, as also by its reaction with caustic potassa, which it colors brown. Heated alone in a test tube, it gives off sulphuretted hydrogen, a proof of the presence of sulphur.* The test for nitrogen, by potassium, gave affirmative results; the density is 1·3. The specimen corresponds in appearance and composition to a perfect lignite of Mont Meisner, as given by Regnault.

An improved Elevating Table was exhibited by the inventor, Mr. John T. Hammitt, of which the top may be raised by turning a crank, so as to convert it from a sitting into a standing table; or, by a similar arrangement, the top may be made flat or sloping. The tables are so constructed as to have a general application to the library and counting room.

Mr. Weygandt presented to the meeting an improved Galvanometer of very great delicacy, and a thermo-multiplyer. In the latter he has succeeded in giving to the concave mirror of bell-metal a true parabolic curve.

Dr. Turnbull exhibited the Artificial Leech, an invention of M. Alexandre, of Paris. It consists of a scarifying tube of copper, which by a simple contrivance exhausts the air, and inflicts a wound resembling in shape that from the leech-bite, after which the blood is drawn by a similar tube of glass. It is, in fact, a tubular cupping apparatus, applicable to cases in which it would be impossible to apply other forms of that apparatus.

Dr. Rand brought forward a new explosive compound known as Napier's Gunpowder, though really the discovery of M. Hugeaud, assayer of the mint at Constantinople. It is composed of chlorate of potassa 2 parts, white sugar and ferrocyanide of potassium each 1 part. Its explosive power is stated at three times that of gunpowder. It explodes with great

* Analysis gives the proportion of sulphur 1·97.